JPRS-JST-93-024
24 November 1993

JPRS Report

Science & Technology

Japan

Agency of Industrial Science and Technology 1993

Science & Technology

Japan

Agency of Industrial Science and Technology 1993

JPRS-JST-93-024 *24 November 1993*

CONTENTS

Agency of Industrial Science and Technology 1993

43070008A Tokyo MINISTRY OF INTERNATIONAL TRADE AND INDUSTRY 1993 in English
1993 pp preface, 1-38

[Text]

Overview of the Agency of Industrial Science and Technology

Tremendous progress is being made today on the cutting edge of science in such fields as electronics, new materials and biotechnology, in all of which Japan is now acknowledged to be a world leader. Even so, if this country is to rise above national interests and play the role in the global community that its international stature demands, then, in the ongoing quest for solutions to such problems as those of energy and the environment, it will need to put more effort than ever before into basic original research and development.

It is with this goal in mind that the Agency of Industrial Science and Technology of the Ministry of International Trade and Industry will go about its activities during FY93, putting into effect a comprehensive industrial technology policy designed to encourage the development and dissemination of technologies that are both environmentally sound and people-friendly. The Agency has three basic policy objectives: a fundamental overhaul in the way research is organized, the establishment of a new R&D project system, and the fostering of joint international research. Within this framework the following specific measures are being implemented.

Under the first objective, reorganizing the research system, the old National Chemical Laboratory for Industry, Fermentation Research Institute, Research Institute for Polymers and Textiles, and Industrial Products Research Institute were dissolved and replaced by a new National Institute of Materials and Chemical Research and a National Institute of Bioscience and Human-Technology established on 1 January of this year. Materials research and biotechnology constitute two key areas in applied science as the 21st century approaches, and both the new institutes are committed to becoming centers of research in their fields. A new interdisciplinary Industrial Technologies Research Institute has also been set up, where extensive work is planned on crossover research combining knowledge from different fields, an area that has been rapidly gaining importance in recent years.

The Agency's second basic objective is creating a new R&D project system. To this end the current National Research and Development Program (the so-called "Large-Scale Projects"), the Research and Development Project on Basic Technologies for Future Industries, and R&D on Medical and Welfare Equipment Technology are to be combined into a new Industrial Science and Technology Frontier Program, under which fundamental creative research and development work is to be conducted with the goal of creating new forms of technology or further developing the society. At the same time, as part of the quest for solutions to the urgent global problems of energy and the environment, the Agency will launch a new research and development program, the New Sunshine Program (R&D program on Energy and the Environment Technologies). Absorbing the current set of programs in these areas (the Sunshine Project, the Moonlight Project, and the R&D Program on Technologies Relating to the Global Environment), the New Sunshine Program will foster the development of innovative technologies in the fields of energy and the environment in a fashion never done before.

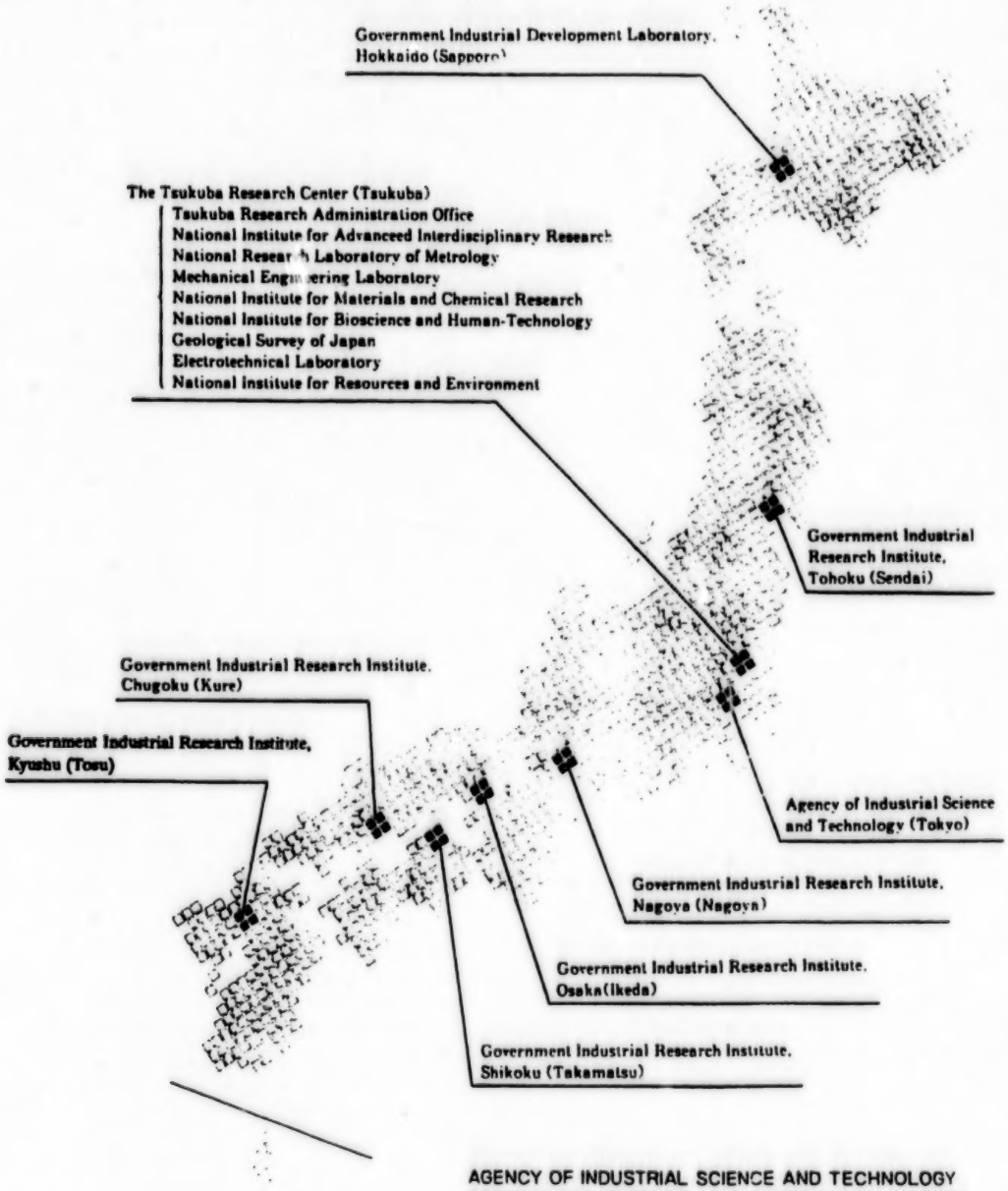
The third basic objective, contributing to the global community, is the inspiration behind the Human Frontier Science Program proposed by Japan in order to implement basic research on the workings of that marvelous machine the living organism, as well as the system of grants to international joint research teams administered by the New Energy and Industrial Technology Development Organization (NEDO). The Agency will also foster comprehensive international cooperation on research with developing countries, developed nations, and former members of the Communist Bloc.

In addition to the above the Agency will be involved in a wide range of other activities as well. There has been concern in recent years about declining interest in science and technology among young people and the shortage of qualified personnel in science and technology fields: to cope with this the Agency is to undertake an industrial technology succession program, which will nurture outstanding talent in science and technology, and encourage creative, successful approaches to research and development by acquainting a new generation with the dreams of those who explored the frontiers of industrial technology in the past and the devotion and hard work with which they brought them to pass. Among other items on the Agency's agenda: ensuring ample funding for the Japan Key Technology Center, which helps the private sector in developing technology; furthering joint research with the private sector and regional organizations under the Specific Regional Technology Development System and similar programs; and continued work in the field of administration of industrial standards, for which there is now a greater need than ever before both at home and abroad, including promoting the ISO-9000 and advancing basic research on standardization in order to help improve the quality of life for all Japanese.

I do hope this pamphlet will give you an idea of the types of programs administered by the Agency of Industrial Science and Technology.

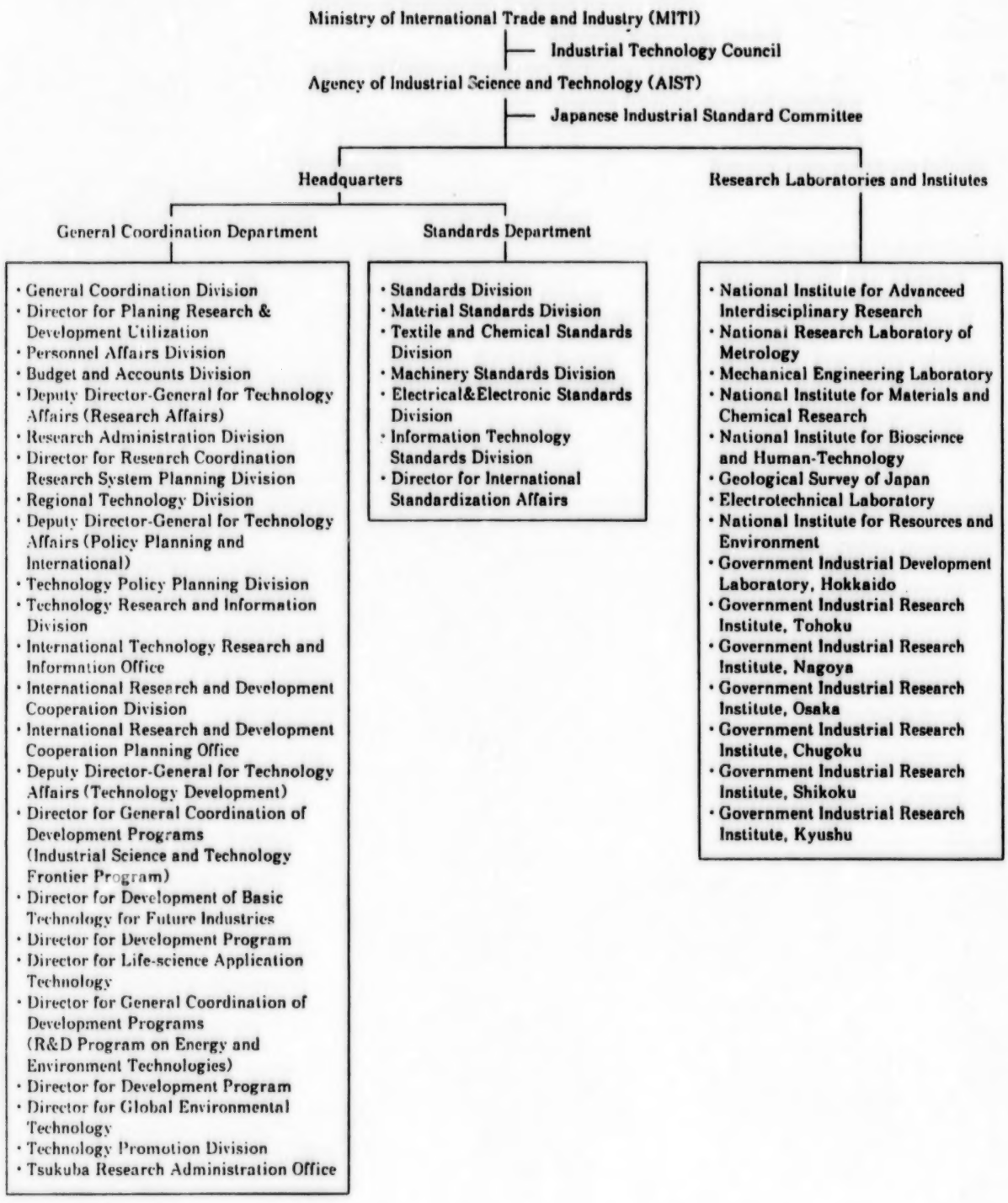
Dr. Hiroshi Kashiwagi, Director-General, Agency of Industrial Science and Technology

Laboratories and Institutes

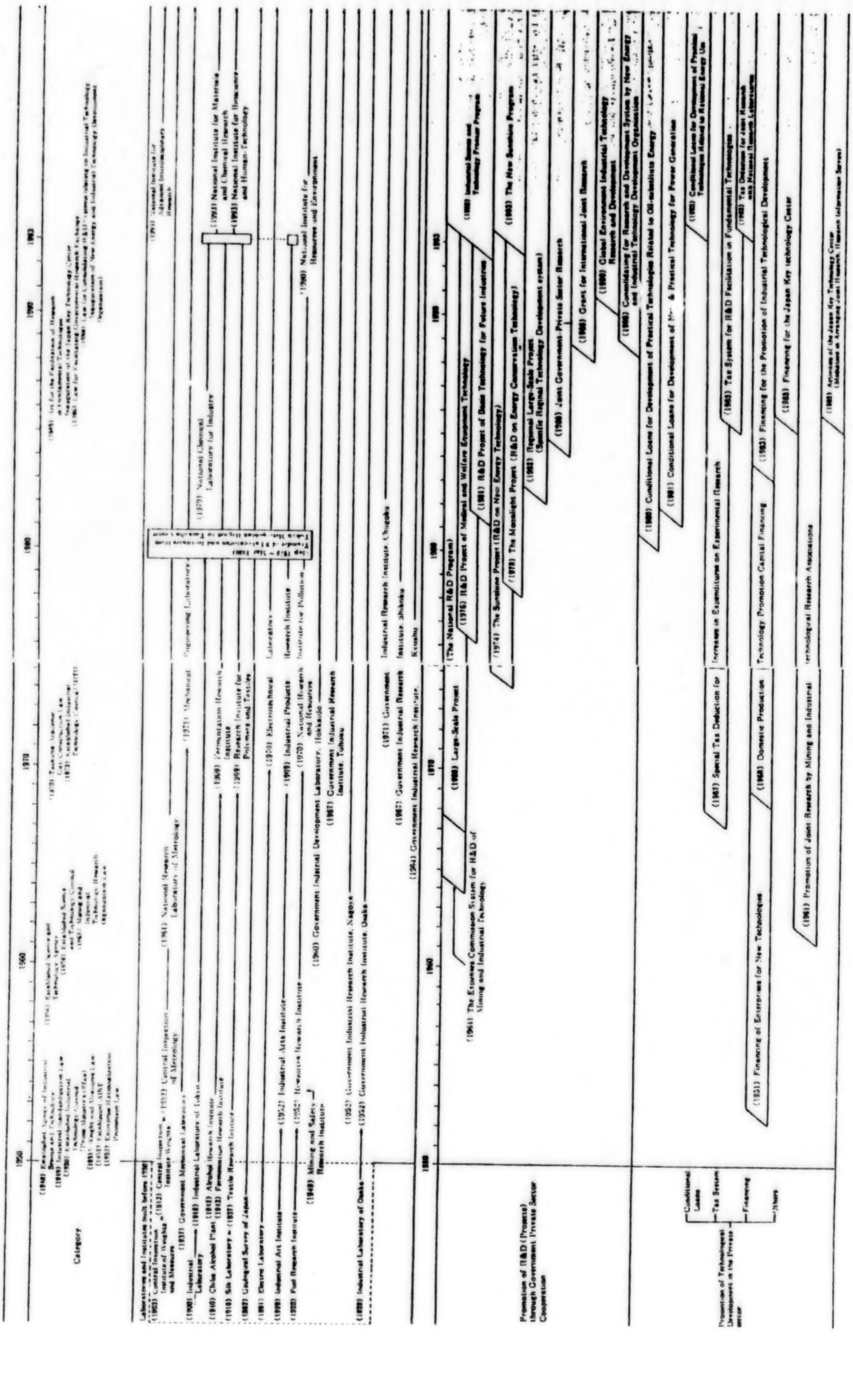


AGENCY OF INDUSTRIAL SCIENCE AND TECHNOLOGY
TECHNOLOGY RESEARCH AND INFORMATION DIVISION
1-3-1, KASUMIGASEKI, CHIYODA-KU, TOKYO 100, JAPAN
TELEPHONE. (03) 3501-1511

Organization of AIST



History of AIST



FY1993 Budget for Industrial Technology in MITI (Outline) (Unit: one hundred million yen)

Item	Budget for FY1992	Budget for FY1993	Change Amount
Total	2,592	2,820	228
Consisting of: General accounts	703	732	29
Special accounts	1,623	1,828	205
Industrial investments accounts	267	260	-7
1. Fostering More Extensive Basic Original Research Etc.			
(1) Establishing an Industrial Science and Technology Frontier Program	236	253	17
(2) R&D Program on Energy and Environment Technology (New Sunshine Program)	503	539	36
(3) Fostering R&D on Medical and Welfare Equipment Technology	7	10	4
(4) Advancing Basic Research on Industrial Standards	0	9	9
(5) Supporting Installation of Technological Infrastructure			
(a) Encouraging R&D by the Private Sector	2	3	1
(b) Support Through the Japan Key Technology Center	285	280	-5
(c) Promoting Installation of Basic Research Infrastructure and Implementation of R&D Relating to DNA Analysis	0.4	3	2
2. Development of Industrial Technologies			
(1) Fundamental Improvements in Development of Technologies in the Fields of Energy and the Environment			
(a) Encouraging Development of Applied Technologies Relating to Rational Energy Use	0	13	13
(b) Developing Clean Coal Technology	57	69	11
(c) Promoting Development of Industrial Technologies Relating to the Global Environment Etc.	79	102	23
(d) Developing a System for Utilizing Data From Earth Observation Satellites Etc.	14	11	-3
(e) Fostering Development of Alternatives to Chlorofluorocarbons	12	15	3
(2) Enhancing Development of Technologies Designed to Improve Quality of Life			
(a) 21st Century Housing Development Project	17	18	1
(b) Mellow Society Concept	2	2	0
(c) Promoting Installation of Safety-Related Infrastructure	0	0.1	0.1
(3) Fostering Development of Information-Related Technologies			
(a) Development of New Information Processing Technologies (the Four-Dimensional Computer)	9	36	27
(b) Laying the Foundations for Research on Fifth-Generation Computer Technology	36	14	-22
(4) Promoting Development of Technologies for Small Businesses			
(a) Developing Technologies for Alleviating Manpower Shortages in Small Businesses	14	13	-1
(b) Project for Promoting Strategies on Energy and the Environment Among Small Businesses	0	2	2
(5) Fostering Development of Specific Regional Technologies	4	11	7
3. Contributing to the International Community in the Field of Industrial Technology			
(1) Fostering Comprehensive International Cooperation on Research	10	18	8
(2) Promoting Joint International Research			
(a) Human Frontier Science Project	19	19	0
(b) Grant Program for Joint International Research	7	9	2
(c) Joint International Research Program on an Intelligent Manufacturing System (IMS)	8	11	4
(d) Joint International Aircraft Development	81	82	1
(e) Developing an Unmanned Space Experiment System	141	127	-15
(3) Technology Transfers			
(a) Expanding and Improving International Cooperation on Energy and the Environment (Green Aid Plan)	27	129	102
(b) Research Cooperation Programs	26	28	2

FY1993 Budget for Agency of Industrial Technology (Unit: million yen)

Description	Budget for FY1992	Budget for FY1993	Notes
Budget for the Agency of Industrial Science and Technology			
General Accounts	55,916	58,484	+4.6% (2,568) over previous year
Of which non-personnel expenses	27,678	29,009	+4.8% (1,331) over previous year
Special Accounts	57,945	6[illegible]8	+12.0% (6,953) over previous year
Of which:			
Electric Power Special Account	22,768	29,514	+30.0% (6,746) over previous year
Fossil Fuels Special Account	35,177	35,383	+0.6% (206) over previous year
Total	113,861	123,382	+8.4% (9,521) over previous year
Funding for Small Enterprise Assistance Programs (amount budgeted under other agencies)	850	900	+5.9% (50) over previous year
Official Development Assistance (amount budgeted under other agencies)	372	407	+9.7% (36) over previous year
Grand Total	115,083	124,689	+8.3% (9,606) over previous year
1. Installation of Infrastructure for R&D			
Facility construction and maintenance funding	1,865	2,136	For constructing separate facilities for collaborative research between industry, government and universities, joint international projects etc., and implementing measures against building deterioration.
Expansion of research information infrastructure	5	135	
Of which:			
Installation of AIST Network	0	50	A high-speed public network providing links with regional laboratories.
Installation of Patent Data Support System	5	85	To lay the groundwork for computerization and office automation.
Assistance for Tsukuba reorganization (facility transfers)	13	204	Covers costs of moving research departments, laboratories etc.
2. Fostering More Extensive Basic Original Research Etc.			
Advancing Industrial Technology Research and Development	*23,563	*25,267	Reorganization of "Large Projects," the Future Industries Project etc., in order to increase effectiveness of R&D in fields with a high degree of basic/original content.
Of which: Leading research	0	246	Inorganic fusion materials with higher order structure, autonomous reaction materials, technology for utilizing functions of tropical organisms, femtosecond technology, ecofactory technology etc.
Overall Advancement of the Project for the Promotion of Integrated Technology Development in the Fields of Energy and the Environment (New Sunshine Project)	*50,255	*53,901	Closely integrated development of energy and environmental technologies formerly covered by the Sunshine and Moonlight Projects and R&D program on technologies relating to the global environment.
Of which: Broad area energy utilization network system (Eco-energy city)	0	*610	
International clean energy network using hydrogen conversion	0	*412	
Lean-burn de-NOx catalyst technology etc.	40	*415	
Improvements in crossover research combining knowledge from different fields	154	303	Interdisciplinary Industrial Technologies Research Institute established to implement crossover research etc.
Fostering R&D on Medical and Welfare Equipment Technology	687	1,044	Grants for practical applications, basic research on welfare apparatus technologies etc.
Specific Regional Technology Development Projects	*368	*679	R&D programs coordinating the efforts of researchers at the national and regional levels, involving locally-based national and publicly-funded research laboratories, private-sector companies etc.

FY1993 Budget for Agency of Industrial Technology (Unit: million yen) (Continued)

Description	Budget for FY1992	Budget for FY1993	Notes
Of which:			
Advanced bio-materials production and processing technology	24	*140	
Multiple-function component structure control technology	0	*213	
Laying the groundwork for the implementation of industrial standards	0	71	Installing the necessary infrastructure for industrial standardization, improving the support system for basic original research.
Conditional loans for development of applied technologies relating to rational energy use	0	*1,306	In order to provide funding for application of technologies for rational energy use by the private sector etc.
Implementation of the twin research institute system	0	9	Involving systematic research exchange programs between AIST laboratories and overseas institutions with advanced research potential.
Special laboratory research	2,691	2,760	
3. Promoting International Research Cooperation			A system of cooperative international research utilizing the considerable research potential of Japan's national laboratories.
Fostering comprehensive international cooperation on research	*1,022	*1,847	
Of which:			
With developing nations	372	407	
With developed nations	*650	*1,401	
With former Communist Bloc nations	0	39	
Human Frontier Science Project	*1,552	*1,553	A basic research program on the workings of the human organism involving scientists from around the world.
Joint international research projects (NEDO grant program)	*676	*883	International collaboration on original and advanced fields of basic research.
OECD/CSTP contributions	0	5	In order to provide the necessary funding for coordinating policies on technology among different countries and increasing mutual understanding.
4. Other Expenditures	0	*36	Our industrial technology heritage and making creative use thereof.
Discussion meetings on industrial technology and its history			

*: Amount including Special Account funds.

Framework for R&D by MITI in the Areas of Industrial Science and Technology

The Framework for R&D by MITI in the areas of Industrial Science and Technology is to show basic policy in the field of industrial technology, directions to be pursued, methods of implementation, and specific research themes of the R&D (conducted) by MITI, with the objective of ensuring that those R&D are conducted in a systematic and effective fashion.

The main points of tentative plan of the Framework drafted in January 1993 are as follows:

(1) The basic principle to be that of "technoglobalism"

Greater emphasis is to be placed on creative activities and the circulation and exchange of ideas in the field of science and technology at the international level. Efforts will also be put into disseminate science and technology, improving open R&D environment, and fostering international R&D cooperation.

(2) R&D fields to be given priority

(a) Basic and original research and development

Basic and original research and development, with its potential to produce major breakthroughs, will be given special attention.

(b) R&D from a global, international perspective

R&D will be promoted in the areas of preserving the natural environment, development and utilization of energy, exploitation of resources etc. in order to

seek solutions to such challenges confronting all mankind such as destruction of the environment and the North-South problem.

(c) R&D to improve the social welfare

Special emphasis will be placed on R&D, which have little chance of development when left only to market force, and which pursue this goal on the basis of an accurate assessment of changes in social structure and the needs of society and people.

(3) Improvement of R&D structure etc. in order to maximize the effectiveness of R&D

(a) National research laboratories

—To pursue R&D beyond the capacity of the private sector, such as basic and original R&D to plant new seeds for the future.

—Reorganization of National Research Laboratories, giving birth to National Institute for Advanced Interdisciplinary Research and other two institutes.

—Providing a free and competitive research environment through enhancement of research support system and extension of the discretion of the laboratory management.

—Improvement of research evaluation system including the formation of an international advisory committee to assess results.

(b) National Projects etc.

—To be promoted where the combined technical expertise of industry, government and universities is essential, to have certain degree of effect on society/living standards.

—Reorganization of National project schemes giving birth to Industrial Science and Technology Research and Development Program and New Sunshine Program.

—Sufficient research support system for adoption of concentrated research methods.

—Improvement of research evaluation systems by e.g. implementing preliminary and basic research at the pre-project stage.

—Flexibility is to be shown in revising and even canceling projects through the implementation of rigorous review on the midway through the project.

(4) Specific subjects in 12 research areas identified

Industrial Science and Technology Frontier Program

In the 27 years since its establishment in 1966 the National Research and Development Program (the so-called "Large-Scale Projects") has pioneered research and development on large-scale industrial technologies, most notably system and plant technology. The Research and Development Project on Basic Technologies for Future Industries meanwhile has, since its initiation in 1981, concentrated on the development of innovative basic technologies, especially key constituent technologies. The R&D program on medical and welfare equipment technology for its part has, since it was set up in 1976 pursued research and development designed to enhance the well-being of all members of society. These programs, funded by government and involving close cooperation between the private and public sectors and universities, have made a tremendous contribution to the growth of Japan's industrial technology. But with the blurring of the line between science and technology in recent years and advances in industrial techniques the need has arisen for coordinated management of the "Large-Scale Projects" and Future Industries programs, while at the same time basic research and application of the latest technologies from many different fields have become indispensable for developing medical and welfare equipment. For this reason the three programs have been combined into the Industrial Science and Technology Frontier Program as of fiscal year 1993. Furthermore, leading research is being conducted on certain topics on which it would not be viable to launch projects immediately due to such obstacles as clearness of technology; this involves preparatory studies and preliminary surveys designed to assess among other things the advisability of a project.

Activities of AIST

(Unit: million yen)

Project Name	Period (FY)	Budget for 1993	Outline of Project
[Superconductivity]			
Superconducting Materials and Devices	1988-1997	3,226 0 3,226	Development of new superconducting materials, processing technologies for applying superconducting materials to electric power equipments, e.g. magnets and wires, and technologies for fabricating superconducting electronic devices.
[New Materials]			
High-Performance Materials for Severe Environments	1989-1996	1,766 78 1,688	Development of carbon/carbon composites, intermetallic compounds, and fiber reinforced intermetallic which can be used to develop a space plane and SST/HST.

Activities of AIST (Continued)

(Unit: million yen)

Project Name	Period (FY)	Budget for 1993	Outline of Project
[New Materials] (continued)			
Non-linear Photonics Materials	1989-1998	590	Development of photonics materials which exhibit high non-linear optical susceptibilities and short response times for application of optical devices.
Advanced Chemical Processing Technology	1990-1996	1,850 89 1,761	Research and development on three new processing technologies for producing new functional materials: (1) ultra-high purity separation; (2) ultra-fine-grain crystal control technology, and (3) synthesis for high-performance organic materials; as well as development of measuring and control technologies to support these.
Silicon-based Polymers	1991-2000	568 355 214	Research in technologies for the molecular design and synthesis of silicon-based compounds, and development of properties such as high heat-resistance, strength, and superior electrical characteristics.
[Biotechnology]			
Fine Chemicals from Marine Organisms	1988-1996	1,433 303 1,130	R&D on biotechnological production of fine chemicals such as pigments, dyestuffs, moisturizing materials, and coating materials for underwater structures.
Molecular Assemblies for a Functional Protein System	1989-	557 0 557	Development of molecular assemblies of functional proteins for reactors with sophisticated functions such as production and conversion of complexed biomaterials coupled with selective transport and recognition.
Production and Utilization Technology of Complex Carbohydrates	1991-2000	438 127 310	Research and development regarding the in vivo, in vitro and chemical synthesis, and the application of sugar chains, which combine with proteins and fats, and play an important role in improving their function.
[Electronics, Information and Communication]			
Bio-electronic Devices	1986-1995	291	Research and development on bio-electronic devices to realize biological information processing functions.
New Models for Software Architecture	1990-1997	306	Research and development of innovative models for flexible software architecture so that software can function according to the surrounding situation.
Quantum Functional Devices	1991-2000	721 0 721	Research and development of control technology of new device functions based on such quantum effects as wave properties for the purpose of developing ultra-high-speed, multi-function electronic devices.
Ultimate Manipulation of Atoms and Molecules (Atom Technology)	1992-2001	501 98 403	Research on precise observation and control of individual atoms and molecules on material surfaces and in space, a fundamental technology applicable to a wide range of industrial fields.
[Machinery and Aerospace]			
Advanced Material Processing and Machining System	1986-1993	1,670 79 1,591	Research and development on high-power excimer laser technology, high-energy ion beam technology, ultra-precision machining technology etc. as part of the effort to develop super-high-precision hyperfine material processing and super-high-grade surface refining techniques, which are beyond the capabilities of traditional processing technologies.
Super/Hypersonic Transport Propulsion System	1989-1998	4,053 211 3,842	R&D on a combined-cycle engine which will combine the "ramjet" and "high performance turbojet," and provide high reliability and efficiency at both the subsonic and the hypersonic level.
Micromachine Technology	1991-2000	1,503 99 1,404	R&D on technologies required f manufacturing micromachine systems to perform precise operations such as inspection, diagnosis and repair (or treatment) in restricted spaces in equipments, in vivo, etc.
[Natural Resources]			
Manganese Nodule Mining System	1981-1996	1,060 590 471	R&D on an efficient and reliable hydraulic mining system in which manganese modules are collected by a towed vehicle for commercial-scale mining to help ensure a stable supply of non-ferrous mineral resources.
[Human, Life, and Society]			
Underground Space Development Technology	1989-1995	1,422 143 1,279	R&D on underground space development technology are as follows: (1) geological survey and evaluation technology; (2) dome construction technology; (3) environment conditioning and hazard prevention technology
Human Sensory Measurement Application Technology	1990-1998	2,067 940 1,128	R&D on technologies for measurements of psychological and physiological effects, method of quantitative analysis and evaluation of complicated human sensation, and sensory evaluation simulator.

Activities of AIST (Continued)

(Unit: million yen)

Project Name	Period (FY)	Budget for 1993	Outline of Project
[Health, Medical and Welfare]			
Non-Invasive Continuous Blood Glucose Monitoring in System	1990-1993	72	System to measure the valve of blood glucose non-invasively and continuously with bio-sensor.
Optical Tomographic Imaging System	1992-1998	96	Diagnostic system for generating tomographic images of oxygen metabolism by the CT (computer tomography) method using near-infrared light; for diagnosing tissue metabolism and circulatory diseases.
Stereotactic Treatment System for Cancer	1992-1996	101	Development of an effective treatment system for cancers that cannot easily be treated by surgery. High doses of X-ray irradiation are applied to the lesion using computer control with almost no injury to normal tissue.
Digital Hearing-Aids	1990-1994	112	Hearing-aids with methods for changing the sound speed and stressing certain sound frequencies.
Ambulatory Apparatus with Weight Bearing Control System	1991-1995	103	Device to enable a person with paralyzed limbs to walk by automatically adjusting the artificial limb length.
Next-Generation Oral Device Engineering System	1993-1997	41	A total system for low-cost design and production of highly customized false teeth, crowns and other oral devices. Consists of a three-dimensional measuring apparatus, design-support equipment with access to database of tooth forms, and a high-precision automatic manufacturing machine.
Evacuation Care System	1989-1993	75	System to crush and remove the solidified feces standing in the rectum with supersonic vibration.
Device for Preventing and Training Urinary Incontinence	1991-1994	86	Device that measures the volume of bladder urine by non-invasive continuous monitoring system, controls alarm and urination while training the urinary function by biofeedback control.
System for Supporting Independent Evacuation	1993-1998	20	Development of a system allowing persons with a physical handicap to go to the toilet unassisted, consisting of a device that helps the user raise his or her body from the lying position and get to the toilet, along with associated equipment designed to maximize comfort and facilitate sanitary disposal of waste.
Three-Dimensional Information Display Unit for the Blind	1989-1993	69	System to form tactile solid body out of pin display of high density for visual handicapped.
Comprehensive System for Supporting Wheelchairs	1993-1998	32	Development of a system to support selection, design and manufacture of the wheelchair best-suited to the individual user; also, development of a low-cost, space-saving conveyance system requiring a minimum of installation procedures to assist in the movement of wheelchairs up and down stairs and ramps in public facilities
Survey on an International R&D Cooperation in the Field of Medical and Welfare Apparatus	1992-	19	A survey to lay the groundwork for an international research program on medical and welfare apparatus, which would meet the domestic and overseas need for preventative, diagnostic and treatment devices for cancer, diseases of the circulatory system, AIDS and other serious illnesses as well as for other devices such as artificial organs and sensor substitutes.
Fundamental Research on Welfare Apparatus Technologies	1993-	60	A multidisciplinary research project on basic welfare apparatus technologies.
Project for the Collection, Analysis and Distribution of Information Welfare Apparatus	1993-	52	Survey on application of technologies: Identification and adaptation of potential technologies that can be incorporated into actual welfare apparatus. Compilation of a database: Compilation of a database of elderly and handicapped persons in order to serve as a basis for developing equipment.
Project for Promoting the Development of Practical Welfare Apparatus	1993-	106	Support for development of practical welfare apparatus incorporating new technologies developed under the R&D program on medical and welfare apparatus technology, by national research institutes, or independently by the private sector.

Activities of AIST (Continued)

(Unit: million yen)

Project Name	Period (FY)	Budget for 1993	Outline of Project
[Leading Research]			
Integrated Inorganic Materials	1993-undecided	51	We'll identify new concepts relating to and the technical practicality of simultaneous control of the structure of inorganic substances at all structural level from the atomic and molecular level through the macro level (higher order structure control), as well as demonstrate the feasibility of creating inorganic substances integrating multi-functions, including dynamic, electrical and chemical functions etc.
Autonomous Reaction Materials	1993-undecided	49	This project deals with macromolecules which undergo a variety of changes in their molecular structure and state of aggregation in response to external stimuli in the form of light, heat, electricity, chemical substances etc. (autonomous reaction). Substances that respond to stimulation will be synthesized and explored, and research will be conducted on raising efficiency and reliability of substance functions. An assessment and analysis will also be carried out of autonomous reaction functions.
Technology for Utilizing Functions of Tropical Organisms	1993-undecided	52	The tropics possess an abundance of biological species with properties as yet unknown, constituting a potentially valuable resource for humankind. Basic research will be conducted with a view to protecting these diverse organisms and utilizing their biological functions.
Femtosecond Technology	1993-undecided	48	Basic technology for femtosecond (10^{15} second) phenomena, such as generation and control technology of femtosecond optical/electrical pulses, will be studied through the elucidation of physical phenomena in femtosecond time region. This technology will contribute to the future information society as one of infrastructures.
Ecofactory Technology	1993-undecided	47	The goal of this project is to establish a coherent set of technologies, known collectively as "Ecofactory (Ecology-Conscious Factory) Technology," emphasizing recycling of resources in response to the growing burden placed upon our planet by the consumption and disposal of industrial goods. To this end basic leading research will be conducted on production and reduction technologies and systematization methods.

Note: In the column "Budget for FY1993" the upper figure represents total amount, the middle figure General Accounts and the lower figure Special Accounts. Where there is only one figure it is for General Accounts only.

The Ministry of International Trade and Industry launched the Sunshine Project on new energy in 1974 and the Moonlight Project on energy conservation saving technology in 1978. Since 1989 it has also implemented R&D on the global environment technology.

However, in consideration of the close interrelationship between the problem of the environment and that of energy, the New Sunshine Program (R&D Program on Energy and Environmental Technologies) was initiated as of fiscal 1993 with the aim of coordinating research and development in these areas and ensuring rapid progress on both fronts.

The New Sunshine Program will accelerate development of innovative technologies in an internationally open fashion, as well as promote international research projects on common global themes and joint research work with developing nations on appropriate technologies.

The New Sunshine Program

(Unit: million yen)

Project Name	Budget for 1993	Outline of Project
[Renewable Energy Source]		
Solar Energy	7,660 53 7,607	(1) Research and development of high-performance and low-cost solar-photovoltaic conversion technology which is expected to be widely used by early 21st century. The price of photovoltaic cell has been reduced from 20,000 - 30,000 yen/W peak to 650 yen/W peak. The electricity cost of solar-photovoltaic-conversion system has been reduced from 2,000 yen/kWh to 20-30 yen/kWh. (2) Development of solar-thermal-application systems for supplying industrial process heat which are required serious thermal management to keep quality controls. Technology of refrigeration warehouse system (-5°C) driven by solar-thermal energy has been achieved. In FY1992 solar driven refrigeration warehouse was constructed and has seen operated.
Geothermal Energy	4,606 31 4,575	(1) Research to confirm the effectiveness of exploration techniques for geothermal resources in fracture-type reservoirs. As of FY1992 a highly accurate MT technique had been developed. In addition, application of VSP had been tested, and a highly accurate reflection method had been well-adapted to explore fracture-type reservoirs; an array-type CSMT had been developed; basic experiments of seismic tomography had been conducted; and a prospecting method using microearthquakes had been developed. (2) Development of a binary cycle power generation plant and a hot dry rock power generation. As of FY1992 a down-hole pump had been developed for conveying hot water up from underground for the binary-cycle power generation. In the test field or the hot dry rock power generation, an artificial geothermal reservoir had been constructed and short-term circulatory extraction successfully performed. In addition an artificial geothermal reservoir had been constructed at a depth of about 2,200m.
General Research—(Wind Energy), (Ocean Energy), (Bioenergy)	1,052 89 962	(1) Wind Energy: (a) Research on a wind energy conversion systems: Theoretical and experimental studies are conducted on rotor aerodynamics, control systems, transmission systems, vibration and material to develop wind turbine generator systems of high performance. (b) Development of large-scale wind turbine generator systems: The objective of this project is early development of a reliable and economical large-scale wind turbine generator systems. Rotor performance, environmental impacts such as noise, structural engineering and scale-up technology are studied. (2) Ocean Energy: (a) Basic research on an ocean thermal energy conversion system: Ocean thermal energy conversion refers to the generation of electricity by utilizing differences in water temperature between the surface and depths of the ocean to run heat engines. This study will examine one such method of generation, the open cycle system, which involves evaporating the sea water itself and rotating turbines to produce electricity. (3) Bioenergy: (a) Research on hydrocarbon production from plants with high CO_2 fixation: A study on setting reaction conditions, identifying optimum catalysts, identifying co-catalysts and carriers, assessing the effect of moisture content etc. (b) Research on efficient photosynthetic production of biomasses: Research on using genetic engineering to improve the photosynthetic and reproductive capacities of algae, particularly blue-green algae. (c) Research on plant-growth regulation for biomass plants: Botanical growth-regulation compounds will be newly synthesized and more active compounds developed based on activity testing.
[Advanced Utilization of Fossil Fuels]		
Coal Liquefaction and Gasification Technology	14,101 198 13,904	(1) Coal Liquefaction Technology: Development of Innovative liquefaction processes for both bituminous and brown coal. Construction of a 150 t/d pilot plant for liquefaction of bituminous coal. Follow-up research of a 50 t/d pilot plant for liquefaction of brown coal. (2) Coal-based Hydrogen Production Technology: Development of coal gasification technology for low-cost hydrogen production energy. Operation of a 20 t/d pilot plant was being operated in FY1992. (3) Integrated Coal Gasification Combined Cycle Power Generation Technology (IGCC; supported by ANRE): Development of the IGCC technology which yields less environmental burden than conventional coal-fired power generation. Operation of a 200 t/d IGCC pilot plant with entrained bed gasifier.
Fuel Cell Power Generation Technology	5,039 16 5,023	Development of fuel cell power generation technology adaptable to both dispersed and centralized power stations. The energy efficiency can reach as much as 40 to 60% and 80% efficiency including co-generation. These fuel cell technologies are low load for environment and also. Natural gas, methanol and coal-derived gas are used as fuels. Progress as of FY1992 was as follows. Research and development work on alkaline fuel cells came to a close in 1984 and that on phosphoric acid fuel cells in 1990 with the accomplishment of the expected objectives. Meanwhile several types of molten carbonate fuel cell have been developed: an external-reforming multiple large capacity cell of 25 kW class at increased pressure, a rectangular large capacity cell of 50 kW class at normal pressure, and an internal-reforming cell of 30 kW class at normal pressure; 1,000 kW class barance of plant have also been developed. In addition, a solid oxide fuel cell module of several hundred watts' capacity has been developed. Work has also begun on developing a 1 kW class polymer electrolyte fuel cell module.

The New Sunshine Program (Continued)

(Unit: million yen)

Project Name	Budget for 1993	Outline of Project
[Advanced Utilization of Fossil Fuels] (continued)		
Ceramic Gas Turbine Project	2,331 55 2,276	Development of ceramic gas turbine engines applicable to co-generation and electric power generation systems. These engines, which can use non-petroleum fuels such as natural gas and methanol, offer thermal efficiency up to 42% by raising the turbine inlet temperature to 1350°C. As of FY1992 experimental research had been completed on 1200°C class ceramic components, making possible the manufacture of large precision components. Some important characteristics peculiar to small gas turbines, such as aerodynamic one were identified through characteristic tests and endurance tests on combustion chambers, compressors and other constituent equipments under near-actual conditions. Experimental work was also carried out on basic ceramic gas turbines (TIT 1200°C).
[Energy Transfer and Storage]		
Superconducting Technology for Electric Power Apparatuses	3,932 16 3,916	Development of a more efficient and stable electric power using superconducting power apparatuses, among which generators are the closest target. The system will assist in overcoming problems such as power loss and lack of suitable sites for transmission lines which offer as power stations become bigger and more remotely situated. As of FY1992 research and development work had been carried out on constituent technologies such as superconducting wire, superconducting generators and refrigerating systems. Work got underway on building a model superconducting generator (70,000 kW class), and preparations were started on verification testing.
Dispersed-type Battery Electric Energy Storage Technology	791 15 776	The aim of this project is to develop a small, high-capacity cell possessing high energy density and requiring a minimum of maintenance and upkeep in order to form part of an efficient electrical power utilization system incorporating load leveling; to this end R&D is underway on a future-type high-efficiency secondary lithium battery. An integrated research program is also being carried out on patterns of power demand and the required capabilities, optimum capacity etc. for a dispersed-type battery electric energy storage system. As of FY1991 progress had been made in developing an advanced battery electric energy storage system with a load leveling function, which utilizes an advanced high-capacity cell to store energy (charge up) at night when demand for electricity is down, then discharge it when demand picks up again during the day. This system has a power output in the 1000 kW class, a standard charge and discharge time of eight hours each, overall energy efficiency of over 70%, and a lifetime of 1500 cycles (approximately 10 years).
[Environmental-Conservation Technologies]		
Lean-burn De-NOx Catalyst Technology	29	The objective of this project is to come up with a method of simultaneously cutting fuel consumption in automobiles while reducing environmental pollution caused by exhaust emissions. A new type of catalyst system will be developed that is capable of effectively removing nitrogen oxides (NOx) in the copresence of oxygen, water vapor, sulfur oxides and other gases from diesel and lean-burn gasoline engine exhaust without adversely affecting fuel efficiency. (1) An analysis will be made of the catalytic reaction mechanisms and the stractures of active sites of zeolite, oxide and metal catalysts. The mechanism whereby catalysts deactivate chemically, physically, or thermally will also be analyzed experimentally. (2) New catalytic substances and structures will be subject to examination, design and modification, and improvements will be made in catalytic performance. Parallel research and development will also be carried out on catalyst preparation techniques such as deposition and molding to establish a set of design and manufacturing technologies for a new type of de-NOx catalyst. (3) The new catalysts will be integrated into engine exhaust systems in the optimum fashion. Catalyst systems will be installed in actual vehicles in order to enable monitoring and assessment of catalytic performance.
R&D on Technologies Relating to the Global Environment	238	(1) Study on artificial photosynthesis and other CO_2 fixation technologies. A research and development project for converting carbon dioxide, thought to be the main cause of global warming, into other useful substances utilizing untapped energy sources such as sunlight. (2) Study on CO_2 fixation by algae etc. An R&D study on nature's capacity to deal with increased amounts of carbon dioxide and what lessons this might hold in framing countermeasures, involving quantitative examination of photosynthesis by algae etc. under different conditions and analysis of its mechanisms. (3) Study on CO_2 fixation by coral. An R&D project on conversion of carbon dioxide into calcium carbonate. An analysis will be undertaken of CO_2 density levels and limestone formation in the past, the condition of coral reefs now, and factors affecting coral formation. (4) Study on CO_2 fixation in deep sea water. An R&D study on carbon dioxide dispersal and fixation methods and behavior of CO_2 under deep-sea conditions. (5) Study on CO_2 separation technologies. A research and development program for effectively separating and concentrating carbon dioxide. (6) Study on CO_2 measurement techniques. An R&D study on technologies for regulating and analyzing the density of the high-reliability reference gases required for accurately measuring carbon dioxide, techniques for measuring CO_2 density in sea water etc. (7) Study on biodegradable chemical substances. A research and development project on plastics, biopolymers and other materials well-adapted to the environment which break down on their own. (8) Study on degradation etc. of methane. An R&D study on methane, which has 20 times the greenhouse effect of carbon dioxide, its degradation process, raw materials etc. (9) Study on evaluation of technologies to counter global warming. A survey of simulation and remote sensing technologies, which are fundamental to any evaluation of countermeasures against carbon dioxide and other greenhouse gases.

The New Sunshine Program (Continued)

(Unit: million yen)

Project Name	Budget for 1993	Outline of Project
[Systematization Technologies]		
Broad-Area Energy Utilization Network System Technology	609 9 600	The aim of this project is the creation of a board-area energy utilization-network system, which is indispensable to the realization of an environmentally-harmonious society where the most of its energy resources are recycled and reused. Research and development work will be conducted for maximizing recovery of low-temperature waste heat, conveying it efficiently over long distances, multi-stage, multi-functional and complex heat utilization and recycling, and optimum system design. (1) Technologies will be developed to enable maximum recovery of the latent and comparatively low-temperature sensible heat contained in large amount of waste heat. (2) Technologies will be developed for transporting recovered heat efficiently over long distances with minimum loss employing chemical reactions etc. a place where it is needed along with heat storage technologies for modulating supply and demand of heat. (3) Technologies will be developed for maximizing efficiency of heat utilization, involving such methods as multi-stage use etc. as best suited to particular conditions in a place where heat is in demand. (4) Research will be carried out on integrated systems, and techniques will be developed for overall optimum system design.
International Clean Energy Network Using Hydrogen Conversion (World Energy Network: WENET)	412 83 328	The concept behind this project is that of a system whereby hydrogen would be produced by breaking down water employing hydro-power or other renewable energy that exist in such abundance around the world, yet remain unexploited; this hydrogen would then be carried over long distances by sea to countries where it was needed, stored, and utilized for generating electricity, transportation, and a wide range of other functions. Research and development work will be carried out with the aim of establishing the key technologies required to set up such a system, producing an optimum network design etc. (1) The necessary groundwork will be laid down for creating an optimum overall system covering hydrogen production, transportation, storage and use. (2) Constituent technologies will be developed for large-scale production of hydrogen by the solid polymer electrolyte water electrolysis. (3) Technologies will be developed for liquefying hydrogen and transporting and storing it in liquid form, as well as for converting, transporting and storing chemical media other than liquid hydrogen that contain that element. Transportation and storage techniques using metal hydride alloys will also be developed. In addition, the necessary knowledge and expertise will be obtained to determine the optimum system for long-distance marine transportation and distributed storage and conveyance of hydrogen. (4) On the subject of hydrogen-combustion power generating turbines, basic research will be undertaken on evaluating the characteristics of various cycles, and constituent technologies will be developed.
[Basic Technologies Relating to Energy and the Environment]	100	(1) Leading and Basic Technology for Energy Conservation: (a) Research on a Hybrid Reactor with High Performance Membrane; (b) Research on the Alkali Metal Thermoelectric Converter (AMITEC); (c) Research on Combined Power Generation Using Binary Mixture Working Fluid; (d) Research on Energy-Saving Organic Synthesis Using Copper Catalysts; (e) Research on Refining Technology for Aluminum Scrap; (f) Research on Non-Contact Thermometry for Advanced Heat Control; (g) Research on Multi-Fuel Capability of Small Cycle; (h) Study of Synthesis of Organic Chemicals with Excimer Lasers; (i) Research on the Development of Soft-Energy converting system with the thermo electric devices.

Note: In the column "Budget for FY1993" the upper figure represents total amount, the middle figure General Accounts and the lower figure Special Accounts. Where there is only one figure it is for General Accounts only.

Survey of Trends in Technology Policy in Japan and Overseas

AIST conducts a comprehensive, in-depth survey of trends in research and development, technology policies and technology development in Japan and other countries in order to provide basic data for planning and drafting of Japan's industrial technology policy. The results of this survey are also used to contribute to the process of coordinating technology policies among countries in international forums.

Domestic Survey

Current conditions in Japan as they relate to industrial technology are surveyed in order to provide accurate data thereon and enable appropriate action. This survey covers trends in research and development of industrial technologies, especially among companies, which account for the bulk of such R&D, the impact of technological innovations on society and economic growth, and public acceptance of new technology, outstanding challenges in the realm of technology and measures to overcome them, and so forth.

Fiscal 1992 Survey Topics

—Analysis of Statistical Data on Research and Development Activities in Japan
—Study on the Future of Industry and Industrial Technology in Japan
—Research on Intellectual Property Disputes and Their Technological Background

Overseas Survey

Surveys on such subjects as trends in technology policies and R&D projects in major countries, opinions on

Japan's R&D activities and obstacles to international cooperation in R&D are conducted. A wide variety of publications, reports and literature on technology in overseas, mainly in the United States and European countries, is surveyed for this purpose.

Fiscal 1992 Survey Topic

— Research and Development Programs Funded by U.S. Government

Participation in OECD Technology Policy Programs

The Committee on Science and Technology Policy (CSTP) of the Organization for Economic Cooperation and Development (OECD) has long served as a forum for exchanges of practical expertise and opinions relating to science and technology between member states as well as undertaken a variety of survey and analysis projects in an endeavor to foster scientific and technical cooperation among members.

Furthermore, in 1993 a group of experts was established to discuss technology policy in order to avoid international friction in this area; progress is thus being made in harmonizing technology policies between countries. AIST has been also playing an active role in such OECD programs, proposing projects for the group of experts and implementing various types of research.

1. Specific Regional Technology Development System (Regional Large-Scale Projects) (Budget for FY1993: ¥1,001 million). To promote regional technology, Specific Regional Technology Development System was established in 1982 and, 11 R&D projects are underway in 7 regions in FY1993. R&D themes included in this system are as follows: (1) Technology strongly demanded by a regional economic society of regions. (2) Technology which cannot be developed independently by a region because of development cost and risk. (3) Technology which requires integrated effort by the government and region for research and development. (See the table below.)
2. Leading Study for Regional Technology Development (Budget for FY1993: ¥24 million). R&D activities are pushed forward on technical fields requested by the region by utilizing the R&D potential of the AIST and under cooperation with public test institutes and regional enterprises. The activities are aimed at technical subjects to be solved for introduction of the technology concerned.
3. Research and a Study on Regional Technologies (Budget for FY1993: ¥5 million). Research and a Study will be made on the recent technical potential and the image of how the efficient R&D system should be in the region.
4. Regional Technology Guidance Program (Budget for FY1993: ¥6 million). Researchers are sent to various parts of Japan and instruction is provided on new technologies in an effort to foster cooperation with all areas of the country.
5. Fostering and Augmentation of Regional Technology Centers. Regional technology centers will be fostered and augmented, and activities of the national regional technology centers conference will be supported.

Measures for Regional Technology Development

(Unit: million yen)

Project Name	Period (FY)	Budget for 1993	Outline of Project
Advanced Utilization of Biomass in Cold Regions	1992-1996 (5)	29	Fermentation, isolation and refinement technologies will be developed for obtaining useful materials such as bioactive substances from agricultural and aquatic resources in cold regions and the waste thereof. Manufacturing and processing methods will also be developed based on such technologies.
Advanced Internal Inspection Technology for Composite Substances (Tohoku Region)	1990-1994 (5)	32	Development of internal inspection system by using ultrasonic imaging, X-ray imaging and image analysis to certify the reliability of an internal structure and of a bonded interface in the composite substances such as ceramic-metal bond, micro-electronic device and carbon fiber reinforced plastic.
Wet Forming of Fine Ceramics (Chubu)	1993-1998 (6)	12	A technology for molding fine ceramic materials will be developed that makes use of a water-based rather than the normal organic form of binder, thus reducing emissions of harmful gases while ensuring high-precision design and high purity at a low cost.
Advanced Surface Modification in Material Processing (Kinki Region)	1989-1993 (5)	33	Development of technology of advanced surface modification for materials such as metals, plastics and ceramics in order to yield mechanical, electrical, magnetical and optical surface functions.
Advanced Design and Manufacturing Technology for Precision Modeling of Sculptured Surface Forms (Chugoku Region)	1991-1995 (5)	29	Advanced designing methods and systems are developed of modeling, manufacturing, instrumentation and molding based on knowledge engineering to make precise products of complicated shapes using sculptured surface forms.

Measures for Regional Technology Development (Continued)

(Unit: million yen)

Project Name	Period (FY)	Budget for 1993	Outline of Project
High-Energy-Beam Hybrid Processing for Function Oceanic Materials (Shikoku)	1993-1997 (5)	12	The objective of this project is to bring about major improvements in the anti-corrosive properties of metals and other materials used in a marine environment. Technology for making the surfaces of various types of materials resistant to the effects of a marine environment will be developed employing a combination of methods including high-energy beams, the most promising technique in this area. This will result in establishment of a surface-processing technology for use in production of sea-based elements with advanced functions.
Hybrid Machining System of Ceramics (Kyushu)	1993-1997 (5)	12	Technology will be developed for cutting and grinding ceramics utilizing such methods as high-frequency vibration, which holds out considerable promise for the processing of materials which present difficulties in this area. A new processing system will then be established that is ideally suited to structural ceramics.
Advanced Combustion Technology Under Micro Gravity (Hokkaido)	1993-1998 (6)	385	The purpose of this project is to establish an advanced combustion technology that is highly efficient and minimizes emissions of environmental contaminants. To this end the parameters governing combustion phenomena will be analyzed using micro gravitational fields, the combustion mechanism will be examined, and a combustion chamber will be developed that is capable of advanced combustion.
New Forming Technology for Composites (Chubu)	1991-1996 (6)	104	A new technology utilizing superplasticity will be developed for molding composite ceramic and metal materials that employ ceramics as reinforcement.
Synthesis and Processing of Advanced Biomaterial (Kinki)	1992-1997 (6)	140	A technology will be developed for producing and processing advanced biomaterials capable of manifesting higher functions characteristic of biological organisms. This will involve creating functional peptides based on molecular design and integrating these into the surface of polymers, ceramics and other materials.
Technology of Structural Control for Functional Composite Materials (Kanto, Kinki, Kyushu)	1993-1998 (6)	213	The aim of this project is to endow equipment components in the fields of aerospace, energy etc. that must operate in a hostile environment with multiple functions, combining such properties as resistance to abrasion and prolonged resistance to acidity with strength at elevated temperature levels and light weight. To this end technologies for controlling the surface structure of materials will be developed utilizing laser, plasma and ion beams etc.

Industrial Standardization

1. Industrial Standards in Japan

AIST supervises Japan's industrial standards in accordance with the 1949 Industrial Standardization Law with the goal of raising the quality of industrial products and encouraging rational production, use and consumption thereof. AIST's activities in this area fall into two main categories: the establishment of Japanese Industrial Standards (JIS) and administration of the JIS Marking System.

(a) Establishment of JIS

A "Japanese Industrial Standards" (JIS) is established whenever there is the need to create a single national standard for the design, quality, performance, or method of production or testing of a particular product.

In recent years the needs of consumers, the requirements of a graying population, environmental concerns and new technologies have also been taken into account in the enactment of JIS, reflecting changes in the structure of Japanese society and the increasingly diverse values of its members.

(b) Administration of the JIS Marking System

Those items covered by JIS which are recognized as protecting the interests of consumers or contributing to the maintenance of safety and hygiene or the prevention of pollution or accidents are designated as eligible for JIS Marking.

Manufacturers producing or processing items so designated may apply to use the JIS symbol, and are authorized to do so after inspection of conditions at their production facilities.

This system has also been applied to overseas factories since 1980 on the basis of the principle of equal treatment at home and abroad.

Basic Statistics:

(i) Total number of JIS: 8,394
(ii) Number of items covered: 865
(iii) Number of Marking permits (in Japan): 15,689
(iv) Number of Marking approvals (overseas): 233

(c) Administration of the Japanese Industrial Standards Committee

Under the Industrial Standardization Low, AIST is given responsibility for administration of the Japanese Industrial Standards Committee (JISC), a deliberative body which considers such matters as the establishment, revision, validation and elimination of JIS and the designation of product categories under the JIS Marking System.

The JISC membership is chosen from among producers, consumers, distributors and neutral parties (academics etc.).

2. Promotion of International Standardization

There is now a greater need than ever before for a sustained effort to establish a set of international standards as the common property of all countries, and Japan is making a definite contribution in this area.

At the same time a rapidly increasing number of the developing nations are turning to Japan for assistance in organizing or upgrading their own internal standardization as a prerequisite to the development of industry and growth of exports. AIST has responded by actively providing aid in establishing such standardization.

(a) Japan's Role in the ISO and IEC

Japan can contribute to the establishment of international standardization by participating in and supporting the activities of international standardization organizations. In specific terms its basic policies in this area are:

(i) to submit drafts of international standards for new technologies etc.

(ii) to accept executive roles on the committees of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC)

(iii) to ensure consistency between international and JIS.

(b) Technical Cooperation With Developing Nations in Enacting Standardization

AIST takes advantage of existing technical cooperation schemes administered by the Japan International Cooperation Agency (JICA) and similar organizations to provide assistance to developing nations. Depending on the nature of the request such assistance may take the form of a technical aid program for establishing standardization involving a combination of project type technical cooperation and aid grants; it might entail the implementation of a survey preliminary to the adoption of a development project designed to foster progress in establishing standards and improving quality control; or it could involve sending experts overseas or bringing personnel from the country in question to study in Japan.

3. Recent Developments in the Field of Industrial Standardization

Social and economic conditions have undergone bewildering change in recent years, and in such times it is essential that the needs of society be promptly and accurately reflected in the way Japan administers industrial standardization.

With this in mind Japan is actively engaged in the following programs in the field of industrial standardization administration:

(a) Dissemination of the ISO 9000 Series and Preparations for Establishment of an Accreditation Body

(i) International Developments

The ISO 9000 Series, a set of international quality control standards, was established by International Organization for Standardization (ISO) in 1987 and has since then spread around the world (in Japan it was incorporated into the JIS system in October 1991). "Quality Systems Assessment and Registration Scheme" utilizing this series of standards is rapidly becoming established in many countries, thus constituting a common set of international criteria for assessing quality control. There is also a growing number of reciprocal recognition of standards between countries under this system.

This system also calls for the establishment of a single authorizing body in each country in order to give credibility to the results of inspection and registration and encourage reciprocal recognition of standards on a global scale. Virtually all the developed nations have already established such a body.

(ii) Establishment of "Quality System Assessment and Registration Scheme" in Japan

Several agencies are already carrying out inspections and registrations in Japan, and the number of companies and plants that have been inspected and registered are rapidly on the increase, most notably in the electronics industry.

Preparations are currently underway for establishing an authorizing body based on the June 1992 report of the Japan Industrial Standards Committee, with industry leading the way. The Ministry of International Trade and Industry for its part is committed to supporting such efforts.

(b) International Standards on Environmental Management

(i) ISO Action on the Environment

In July 1991 ISO established the Strategic Advisory Group on Environment (SAGE) and has since then been examining ways of utilizing international standardization to help conserve the environment.

(ii) Establishment of a Technical Committee to Prepare Environmental Management Standards

ISO is currently completing arrangements for setting up a technical committee to prepare environmental management standards. The committee is to hold its first meeting in Toronto, Canada on 2-3 June of this year.

(ii) Defining Japan's Role

Japan will be asked to make an active contribution to the technical committee's discussions, which could depending on their content have tremendous impact on industry etc. in Japan.

This country is committed to playing a prominent role, and will arrange a series of deliberations at home as well as organizing a delegation to the technical committee involving representatives of industry, academia and the government agencies concerned.

(c) Promoting Basic Research on Standardization and Establishment of the "National Institute of Stands on Lifestyle"

(i) The Need for Basic Research on Standardization

The demands the industrial standardization system is expected to meet have increased in scope in recent years: first, to contribute to a more leisurely, affluent lifestyle, second, to take full account of the aging of Japan's population and growing medical and welfare needs; third, to encourage the development and spread of new technologies; fourth, to deal with problems of the global environment; and so on.

Basic research on standardization is indispensable to meeting such challenges in an appropriate fashion. This would involve for example accumulating and systematizing basic data and establishing test evaluation techniques for it.

Such basic research is also important in another sense: once, on the basis thereof, standards are pioneered in Japan in such fields as these in which little progress has been made in any country on establishing standards, then Japan could make a unique contribution to the international community by presenting them at ISO or similar forums.

(ii) Specific Policies for Promoting Basic Research on Standardization

As of fiscal year 1993 new funding has been obtained under the budget for implementing basic research on standardization relating to human and it's lifestyle, environment, and high technology. This research will be undertaken in cooperation with national research institutes and International Trade and Industry Inspection Institute. In addition a facility for carrying out basic research on standardization, the "National Institute of Standards on Lifestyle," is scheduled for construction on the grounds of the AIST research center in Tsukuba from fiscal years 1993 through 1995.

International Cooperation in Research and Development

International research and development cooperation advances Japan's own R&D while contributing to enhancement of the nation's of harmonious economic ties with other nations.

In order to promote cooperation as such, AIST plays a role of an active research partner with developed and developing countries alike.

AIST conducts joint research programs in the area of advanced technology with developed countries and invites foreign researchers. Besides, under the Institute for Transfer of Industrial Technology Program (ITIT Program), AIST conducts joint research and exchanges of researchers with developing countries.

In addition, The New Energy and Industrial Technology Development Organization (NEDO) helps foreign researchers work and live in Japan smoothly.

1. Cooperation with Developed Countries

(1) Invitation of foreign researchers

1) AIST has established a program in FY1988 to provide foreign researchers with an opportunity to conduct research for a certain period of time with researchers at the institutes of the Agency of Industrial Science and Technology (AIST) in order to advance scientific and technological knowledge in their respective fields and to promote creative research and development in the open environment of the institutes.

a. Qualifications

Generally, a researcher under the age of 35, holding a doctorate in science or engineering.

b. Number and period of invited researchers

Approximately 20 persons for a period of one year

c. Host institutes

Fifteen research institutes belong to AIST

d. Compensation

Round-trip airfare, living expenses, housing allowance, family allowance and relocation allowance

e. Japanese language training

A Japanese language course is given as a general rule at the beginning of the researcher's stay.

Besides foreign researchers can be invited to AIST laboratories by

2) AIST accepts researchers in EC countries through Japan-EC Industrial Cooperation Center

3) Foreign Researchers are invited by a charitable trust called the Japan Trust Fund which is administered by the Japan Key Technology Center.

4) AIST has made a memorandum of understanding with National Science Foundation to accept up to 30 U.S. searchers a year to AIST laboratories.

(2) Joint Research Project

1) Specific International Joint Research Projects

(Research conducted jointly by AIST research institutes and researcher's institutions of developed countries)

Name of Research Project	AIST Research Institute	Counterpart Research Institute	Country	Duration
Research on Generation and Utilization of High Energy Density Plasma	National Institute of Materials and Chemical Research	Technische Universitat Munchen	Germany	1990-1993
Special Purpose Optical Elements for Precision Shape Measurement	Mechanical Engineering Laboratory	Commonwealth Scientific and Industrial Research Organization	Australia	1991-1994
Study on Oxidation Catalyst Bearing Hypervalent Metal Ions	National Institute of Materials and Chemical Research	Senter for Industriforskning	Norway	1991-1994
Research on Crystal Growth by Ion Beam	Government Industrial Research Institute, Osaka	University of Heidelberg	Germany	1993-1995
Basic Studies on Biosensor	National Institute of Bioscience and Human-Technology	VTT Biotechnical Laboratory	Finland	1993-1995
Study on Interoperation Technology for Long Distance Telerobot	Electrotechnical Laboratory	Jet Propulsion Laboratory	USA	1993-1995
Mechanisms for Release of Methane into the Atmosphere by Microganisms	Geological Survey of Japan National Institute of Bioscience and Human-Technology	Ohio State University United States Geological Survey Tubingen Univasitate	USA Germany	1990-1993
Research on Acid Rain Mechanism by the Advanced Observation and Modeling	National Institute for Resources and Environment Government Industrial Research Institute, Nagoya	National Center for Atmospheric Research, Iowa State University	USA	1990-1993
Study on the Cycle of Trace Gases and its Modelling in Both Hemispheres	National Institute for Resources and Environment	Commonwealth Scientific and Industrial Research Organization	Australia	1993-1995
Research on Radiation Thermometry in Ultra-High Temperature Range	National Research Laboratory of Metrology	Institute di Metrologia (G. Colonnetti) Physikalisch-Technische Bundesanstalt National Institute of Standards and Technology	Italy Germany USA	1993-1995

2) Research Grants to International Joint Research Team.

In order to develop future industrial technologies and to contribute to the improvement of both domestic and international joint research team carrying out original research related material fields. This program is administered by NEDO.

3) Bilateral cooperation

AIST cooperates with developed countries such as United States, Germany, France, Italy, United Kingdom, and Scandinavian countries, through science and technology cooperation agreements, industrial cooperation talks and other informal bilateral cooperative relations, by way of joint research, exchange of researchers, and information.

Country	Frame Work	Year of Initiation	Field of Cooperation (Mutually Selected Areas)
U.S.A.	U.S.-Japan Conference on Natural Resources (U.J.N.R.)	1964	Marine Mining, Marine Instrumentation and Communications, Marine Geology, and others
	Agreement between the Government of Japan and the Government of the United States of America on Cooperation in Research and Development in Energy and Related Fields	1979	Fusion, Coal Energy, Solar Energy, High-energy Physics, Other energy and energy-related and development areas, as may be mutually selected.
	Agreement between the Government of Japan and the Government of the United States of America on Cooperation in the field of Environmental Protection	1975	Stationary Source Pollution Control Technology, Air Pollution-related Meteorology, and others
	Agreement between the Government of Japan and the Government of the United States of America on Cooperation in Research and Development in Science and Technology	1988	Life sciences, including biotechnology; Information science and technology; Manufacturing technology; Automation and process control; Global geoscience and environment; Joint database development; and Advanced materials, including superconductors.
United Kingdom	MITI-DTI Talks (Science and Technology Expert Meeting) Science and Technology Round Table Talks	1988 (1990) 1989	Material science, Environment, Biotechnology and others Material science, Marine science, Geoscience and others
France	Agreement between the Government of Japan and the Government of the French Republic on Cooperation in Science and Technology	1990	Marine Science and Technology, Biological and Medical science and technology, New Energy Technology, Energy Conservation, and others
	Implementing Agreement on cooperation in Science and Technology between Japan (AIUST) and France (CNRS)	1991	Ocean Development, New Materials, Biotechnology, Environment, Energy, Lifesciences, and others computer Electronics, New Materials, Biotechnology Environment, and others
Germany	Agreement between the Government of Japan and the Government of Federal Republic of Germany on Cooperation in the Field of Science and Technology	1974	Marine Science and Technology, Biological and Medical Science and Technology, Environmental Protection Technology, New Energy Resources, Transport Technology, New Materials, Data Processing, Information and Documentation, Mechanical Engineering, and others
Australia	Agreement between the Government of Japan and the Government of Australia on Cooperation in Research and Development in Science and Technology	1980	Experimental Petrology, Lower Atmosphere Physics, Fluidized Bed Combustion Technology, Vision Technology for Robots, and others
	Cooperation between Japan and Australia in Energy Research and Development and Related Areas	1978	Coal Technology, Solar Energy Utilization, Energy Conservation, and others
Canada	Agreement between the Government of Japan and the Government of Canada on Cooperation in Science and Technology	1986	Environment Technology, Energy Technology, Space and Communications, Computers and Robotics, and others
Sweden	Japan (AIST) - Sweden (NUTEK) Research and Development Cooperation	1981	Medical and Welfare Technology, Biotechnology, Materials (Polymer and Composite, Ceramics, Lignin), and others
Finland	Japan (AIST) - Finland (TEKES) Research and Development Cooperation	1985	Biotechnology, Computer, New Materials, Environment, Argencmics, and others
Norway	Japan (AIST) - Norway (MOI) Research and Development Cooperation	1991	Energy, especially Energy Conservation, New Materials, Environment, Metrology, and others
Italy	Agreement between the Government of Japan and the Government of Italy on Cooperation in Science and Technology	1988	New Materials, Biotechnology, Volcanology and Seismology, Physics, Environment, Artificial Intelligence Energy, and chemistry

(4) Multilateral cooperation

As for energy R&D projects, MITI participates in cooperative research and information exchange programs under the Committee on Energy Research and Technology (CERT) of the International Energy Agency (IEA).

Working Parties	MITI's Joining Implementing Agreements	Start of MITI's Participation
End Use Technology	- Advanced Heat Pump - Alternative Motor Fuels - Energy Conservation in Combustion - Advanced Fuel Cells - Analysis and Dissemination of Demonstrated Energy Technologies (CADDET) - Assessing the Impact of High-Temperature Superconductivity on the Electric Sector -High Temperature Materials for Automotive Engines	April, 1979 February, 1986 April, 1984 April, 1990 June, 1990 June, 1990 May, 1991
Renewable Energy	- Bioenergy R&D - Wind Energy Systems - Solar Heating and Cooling Systems - Production of Hydrogen from Water -Photovoltaic Power Systems	May, 1987 April, 1978 October, 1977 October, 1977 April, 1993
Fossil Energy	- Coal Technology Information Service - Coal/liquid Mixtures - Enhanced Oil Recovery - Fluidized Bed Combustion - The Testing of High-Temperature High-Pressure Filter - Greenhouse Gases Derived from Fossil Fuel Use	March, 1977 March, 1981 May, 1979 February, 1980 December, 1990 May, 1992
Fusion Power	- Reversed Field Pinches	May, 1990
Other	- Energy Technology Data Exchange (ETDE)	January, 1987

2. Cooperation with Developing Countries

(1) Institute for Transfer of Industrial Technology Program (ITIT Program)

1) Joint Research for New Technology

Name of Research Project	AIST Research Institute	Counterpart Research Institute	Country	Duration (Fiscal Year)
1. Study on countermeasures for the ignition source of gas and coal dust explosions in coal mines	National Institute for Resources and Environment	Central Coal Mining Research Institute	China	1990-1993
2. Development of simple treatment method for highly polluted organic wastewater	National Institute for Bioscience and Human-Technology	Asian Institute of Technology	Thailand	1991-1993
3. Research on exploration and development of mineral resources in Mongolia	Geological Survey of Japan	Institute of Geology and Mineral Resources	Mongolia	1991-1994
4. Study on polyurethanes from lignocellulose	National Institute of Materials Chemical Research	National University	Costa Rica	1991-1994
5. Study of surface machining/ modification	Mechanical Engineering Laboratory	Korea Academy of Industrial Technology; Korea Institute of Machinery and Metals	Korea	1992-1995
6. Study on the development of high performance polymer composite	National Institute of Materials and Chemical Research	National Industrial Technology Institute	Korea	1992-1994
7. Research on coal bearing basins and coal characteristics	Geological Survey of Japan	Oil and Gas Research and Technology Development Center Geological Survey of Malaysia	Indonesia Malaysia	1992-1994
8. Weatherability of polymetric materials in low latitude	National Institute of Materials and Chemical Research	Research and Development Center for Applied Physics	Indonesia	1993-1996
9. Study on design and production of high-quality castings	Government Industrial Research Institute, Nagoya	Standard and Industrial Research Institute of Malaysia	Malaysia	1993-1995
10. Study on hydro-environmental characteristics of arid-semiarid regions in China	Geological Survey of Japan	Institute of Hydrogeology and Engineering Geology	China	1993-1996

Name of Research Project	AIST Research Institute	Counterpart Research Institute	Country	Duration (Fiscal Year)
11. Study on multifunctional energy utilization systems using ocean's temperature differences in vicinity of coral islands	Electrotechnical Laboratory	University of South Pacific	Fiji	1993-1996
12. Efficient utilization of unused tropical biomass	National Institute for Resources and Environment	Institute for Research and Development of Cellulose Industries	Indonesia	1993-1996
13. Study on high quality adsorbent for environmental protection	Government Industrial Development Laboratory, Hokkaido	Thailand Institute of Scientific and Technological Research	Thailand	1993-1996

2) Joint Research for Transfer of Technology

Name of Research Project	AIST Research Institute	Counterpart Research Institute	Country	Duration (Fiscal Year)
1. Thermophysical properties measurement technology for solids and standards reference materials	National Research Laboratory of Metrology	National Industrial Research Institute; Korea Standard Research Institute	Korea	1991-1993
2. Utilization of natural fats and oils as raw materials	National Institute of Materials and Chemical Research	Palm Oil Research Institute of Malaysia	Malaysia	1991-1993
3. Calibration techniques of radiation thermometry in the medium and high temperature range	National Research Laboratory of Metrology	Research and Development Center for Calibration Instrumentation and Metrology	Indonesia	1993-1995

3) General Research

Name of Research Project	AIST Research Institute	Duration (Fiscal year)
1. Study on high performance paper	National Institute of Materials and Chemical Research	1991-1993

4) Joint Research in Cooperation with Other Developed Countries

Name of Research Project	AIST Research Institute	Counterpart Research Institute in Developed Country	Counterpart Research Institute in Developing Company	Duration (Fiscal Year)
1. Mineral resources assessment of fragments of oceanic plates	Geological Survey of Japan	United Kingdom University of London	Indonesia Research and Development Center for Geotechnology Geology and Research Development Center	1992-1995
2. Assessment of pollution by chemical substances	National Institute for Resources and Environment	United States of America Environmental Protection Agency	Kuwait Kuwait Institute for Scientific Research Egypt Mansoura University	1993-1995

5) Joint Research for Technology Related to Global Environment

Name of Research Project	AIST Research Institute	Counterpart Research Institute	Country	Duration (Fiscal Year)
1. Study on afforestation with functional soil improving materials	National Institute of Materials and Chemical Research Government Industrial Development Laboratory, Hokkaido	Central Arid Zone Research Institute Industrial Technology Development Institute	India The Philippines	1990-1993
2. Prevention of expanded pollution in the tropical zone with the metal mining development	National Institute for Resources and Environment	National Department of Mineral Production	Brazil	1990-1992
3. Emission control technology against acid rain related to coal combustion	National Institute for Resources and Environment Government Industrial Development Laboratory, Hokkaido	Beijing Research Institute of Coal Chemistry North East University of Technology	China	1991-1993
4. Study on the water treatment technology using charcoal	Government Industrial Research Institute, Osaka	Forest Products Research and Development Institute	The Philippines	1992-1994
5. Assessment models of air pollution in industrialized cities	National Institute for Resources and Environment	Indian Institute of Technology Indian Institute of Science	India	1992-1994
6. Wastewater treatment from leather industry and recovery of resources	National Institute of Materials and Chemical Research	Xinjiang Chemical Engineering and Research Institute	China	1993-1995
7. Study on environmental effects of industrial waste in subtropical coastal water	Government Industrial Research Institute, Chugoku	Institute of Oceanography of the University of Sao Paulo	Brazil	1993-1996

6) Joint Research for Higher-level Research Activities by Utilizing High-functioning Equipment

Name of Research Project	AIST Research Institute National	Counterpart Research Institute	Country	Duration (Fiscal Year)
1. High performance metal matrix composite materials	Mechanical Engineering Laboratory	Nanyang Technological University	Singapore	1993-1997

(2) Research Cooperation Promotion Activities

Name of Research Project	AIST Research Institute	Counterpart Research Institute	Country	Duration (Fiscal Year)
Research and development project of machine translation system with Japan's neighboring countries	Electrotechnical Laboratory	China Software Technique Corporation and others	China	1987-1994
		National Electronics and Computer Technology Center and others	Thailand	
		Institute of Technology and others	Malaysia	
		Agency for the Assessment and Application of Technology and others	Indonesia	
International research cooperation on recovery of valuable resources in brine	Governmental Industrial Research Institute, Shikoku	Consejo de Recursos Minerales	Mexico	1989-1994
		The Institute of Saline Lakes	China	
Research cooperation for the conservation and sustainable utilization of biological diversity	National Institute of Bioscience and Human-Technology	(Pending)	Thailand Indonesia	1993-1998

(3) Bilateral and Multilateral Cooperation

AIST Promotes bilateral cooperation with China, Korea, etc. through science and technology agreements and Multilateral cooperation with ASEAN countries.

3. NEDO's International Cooperation

NEDO has conducted the following four international cooperation programs intensively, by establishing the International Research Exchange Center in 1989:

(1) International Research Cooperation Program to conduct R&D activities in cooperation with foreign R&D organizations.

(2) International Researcher Exchange Program to invite foreign researchers in the long-term and help them do research and live in Japan smoothly.

(3) Researcher Training Program to re-educate researchers in and of Japan.

(4) International Joint Research Grant Program to contribute the advancement of international exchange.

The Human Frontier Science Program

1. Human Frontier Science Program

It is believed that basic research on the precise mechanisms of organisms has the potential to become a driving force in developing various research areas and could become a treasure chest of scientific and technological seeds, as it is expected to exploit the frontier of scientific technology for the 21st century.

The Human Frontier Science Program is an international joint project in which basic research to elucidate superior functions of living organisms will be conducted in an attempt to utilize its results for the benefit of all human beings.

Voices which call for Japan to contribute more in the field of basic research are growing stronger. In response to this, in the international area, the Japanese government proposed the Program at the Venice Summit in 1987 in an effort to exploit the scientific frontier of the 21st century. After the proposal was adopted at the Venice Summit, an international feasibility study was conducted by scientists in 1987 and successful results were reported at the Toronto Summit in June, 1988.

The organization for the implementation of the HFSP was established in Strasbourg, France in October, 1989. This body, established with about 90% of its operating funds from Japan, administers grants to international research teams, offers fellowships covering travel and accommodation for researchers doing work outside their own country, and sponsors workshops for exchanging and discussing information. The "preliminary stage" of the HFSP came to a successful close in March 1992, and the program has just entered its "main stage" with contributions now being submitted by all participating states (Switzerland joined later).

2. Research and Development Program for the Elucidation of Biological Functions

While promoting the Human Frontier Science Program, the Research and Development Program for the Elucidation of Biological Functions was newly established in 1988 and research is currently in progress at research facilities of the Agency of Industrial Science and Technology in an attempt to elucidate biological functions under investigation.

Promotion of Technological Development in the Private Sector

To encourage R&D by the private sector, tax incentives are offered for technological development as well as financing for the development of industrial technology (through the Japan Development Bank) and conditional loans for Development of Applied Energy Technologies, research association system and so on.

1. Tax Incentives for Technological Development

(1) The following tax incentives have been instituted (effective until March 31, 1995)

(a) Tax Credit for Increasing Research Expenses

An amount equal to 20 percent of the excess of current qualified R&D expenditure over the highest amount of the previous R&D expenditure is deductible from corporate (or income) tax.

(b) Tax Incentive for Promoting R&D in Fundamental Technologies

Also deductible from corporate (or income) tax is seven percent of the acquisition price of facilities for conducting R&D in fundamental technologies. Categories of facilities are stipulated in the Ministry of Finance Notifications.

(c) Six percent of the qualifier expenditure for collaborative research with national laboratories is deductible from corporate (or income) tax.

(d) Tax Incentive for Promoting R&D by Small and Medium Enterprises

Six percent of the R&D expenditure by small and medium enterprises during the business year, applied selectively with (a) above is deductible from corporate (or income) tax.

(2) Special regulation on corporate prefectural and municipal inhabitants tax (effective until March 31, 1995)

Seven percent of the acquisition price of facilities for conducting R&D in fundamental technologies is deductible from corporate inhabitants tax.

(3) Tax Incentives for Mining and Industrial Technological Research Associations

(a) Special depreciation of charges imposed by the research associations is given to members of research associations for acquiring fixed assets used in expert mental research in promoting mining and industrial technology.

(b) Condense recording, down to one yen, of the acquisition price of fixed assets required for the study of mining and industrial technology.

(c) Tax reduction is given on fixed assets used for research.

(4) Special depreciation allowance is permitted for assets used in subject research

(5) Special regulation allowing deduction of the amount of donation to specific nonprofit foundations

2. Financing for Development and Promotion of Technology (Japan Development Bank) (see Table)

Funds are provided at attractive interest rate for the commercialization of new industrial technologies and the construction of special structures for advanced basic research which will make a significant contribution to the advancement of industrial technology and play a key role in upgrading the industrial structure.

3. International Joint Research Grant

In order to develop future industrial technology and improve both domestic and international cooperation on research, grants are given to international joint research teams in material, energy and environmental fields. This program is administered by the New Energy and Industrial Technology Development Organization (NEDO). (Budget for FY1993, ¥881 million)

4. Conditional Loans for Development of Applied Energy Technologies

This system is designed to assist private companies etc. in the application of alternative energy sources to oil, methods of energy conservation and electric power generation. This has the aim of ensuring stable and rational supply of energy and aids in securing stable supply of electric power in Japan. (Budget for FY1993: conditional loans for development of applied oil-substitute technologies—¥1,455 million; conditional loans for development of applied technologies relating to rational energy use—¥1,306 million; conditional loans for development of applied new power generating technologies—¥472 million)

5. Research Association System for Mining and Manufacturing Technology

This system, taking into account the efficiency and importance of joint research by private companies, gives legal status to cooperative research organizations for mining and manufacturing technology. 53 associations are active in March, 1993.

Outline of Finance System for Development and Promotion of Technology

	Development of New Technology		
	Construction of Research Structures	Development for Commercialization	Commercialization of New Technology
Costs eligible for financing	Cost entailed in acquiring special structures and equipment for advanced basic and applied research	-Construction of demonstration plants - Trial manufacture of machinery and equipment	- Production line construction - Development of machinery
Ratio of financing	Approximately 50% of eligible costs		
Financing period	15 years or less (in principle)		
Period of deferment	Two to three years (in principle)		
Budget for FY1933	Industrial Technology Promotion: A fraction of ¥120 billion		

Diffusion of Technological Accomplishments

The agency of Industrial Science and Technology registers as industrial property both at home and abroad the technological accomplishments of its 15 research laboratories and several projects under outside contract, and works to ensure their effective utilization and diffusion.

Patents and other industrial properties (collectively referred to as "patents")* within the jurisdiction of AIST can be licensed to both domestic and foreign companies under certain conditions. They are (1) a license fee is paid, (2) the licensee is capable of using the patents and (3) the licenses are non-exclusive.

Since October, 1985, NEDO conducts management and propagation of accomplishments of developments contacted to NEDO.

1. Patents under AIST's Jurisdiction and Their Licensing

The present status of patents under the jurisdiction of AIST as of March 31, 1992 is shown in the table below. The Agency owns about 15,000 patents in Japan and about 2,300 abroad. As a result, 662 patents are licensed to private and semiprivate enterprises. The revenue from licensed patents totaled ¥200 million in fiscal 1991.

2. System of Disseminating Technological Accomplishments

Permission to use patents under the jurisdiction of AIST, with the exception of some patents, is granted to Japanese and foreign businesses by the Japan Industrial Technology Association (JITA).

JITA is a nonprofit foundation intended primarily to diffuse the technological achievements of AIST. The Association offers: (1) mediation by specialized consultant engineer, (2) conclusion and mediation of state-owned patents, and (3) briefings and publishing of information on state-owned patents likely to be exercised in

the near future, in order to ensure effective dissemination of state-owned patents.

In a tie-up arrangement with the Research Development Corporation of Japan, JITA calls on it to promote diffusion of unused state-owned patents while presenting mutual characteristics.

Industrial Properties Under AIST's Jurisdiction (registered or pending as of March 31, 1992)

	Domestic	Foreign
Laboratories	9,650	1,900
Commissioned research and development	5,591	446
Total	15,241	2,346

Note: Total number of patents utility models designs, and trademarks for "Domestic" and total number of cases for "Foreign"

Industrial Technology Council

1. Overview

The Industrial Technology Council was established on July 25, 1973, as an affiliated institution of the Ministry of International Trade and Industry. ITC officials investigate and deliberate on important matters related to scientific technology in the mining and manufacturing industries in response to inquiries from the Minister of International Trade and Industry.

Conditions affecting Japanese technological development have changed in recent years. The time has come for Japan to develop original technologies in a way that can give full play to national ingenuity and creativity. Moreover, Japan is pinning high hopes on technological development as a means of enhancing the quality of national life, upgrading the domestic industrial structure and contributing to international society.

Under this situation, ITC is working on a broad range of issues related to technological development from a standpoint of MITI as a whole.

2. Activities (Recommendations and Reports Since FY1982)

—Industrial technology development policies (Report of the Planning Subcommittee, Coordinate Committee, November 27, 1984)

—Future System of the Second Round (Report of the Planning Subcommittee, Future Technology Development Committee, June 24, 1988)

—Industrial Science and Technology Policies for 1990s (Report of the Technology Innovation Subcommittee for 1990s, Coordination Committee, May 11, 1990)

—New Evolution of the Sunshine Project (Interim Report of the New Energy Technology Development Committee, June 15, 1990)

—Promoting Technoglobalism and Fostering the COE (Report of the Planning Subcommittee, June 22, 1992)

—Trends and Challenges in Industrial Science and Technology (Summary, Industrial Science and Technology Trends and Challenges Group, Planning Subcommittee, June 22, 1992)

—Themes on Promising R&D Topics in Industrial Science and Technology (Report, Joint Planning Meeting of the Large-Scale Industrial Technology Subcommittee and Future Technology Development Committee, June 22, 1992)

—General Prospects for the New Sunshine Project: A Pillar for the 21st Century (Interim Summary, Joint Planning Meeting of the New Energy) Technology Development Committee, Energy Conservation Technology Development Committee and Global Environment Technology Committee, December 4, 1992)

—Draft Industrial Science and Technology Research and Development Guidelines (Summary, Research and Development Guidelines Committee, January 5, 1993)

—Future Directions in General Policy on Welfare Equipment Technology (Report, Welfare Equipment Technology Policy Subcommittee, January 29, 1993)

Laboratories and Institutes

Technology is a repository of great hope in today's world. At the research laboratories of AIST, work is carried on in developing the leading and basic technologies that will form the groundwork for future technological innovations.

New R&D projects aim at finding solutions to energy shortages, the depletion of the world's natural resources, environmental pollution and other pressing problems.

R&D

Research carried out at AIST laboratories and institutes includes the following characteristics:

—Research and development of leading technologies to form a base for future technological innovation.

—As national institutes, AIST facilities conduct research needed for the propagation of technical standards required for government administration, the establishment, maintenance and supply of standards, and the creation of sophisticated experimental methods.

—Research addressing social needs in earthquake prediction, environmental protection and so on.

—Government support makes possible fundamental and comprehensive experimental research which would be beyond the resources of the private sector.

Research projects are classified into two broad categories: ordinary fundamental research and special research. Research institutes under AIST have over 600 ordinary research themes and about 150 special ones. These are further classified into 18 fields, such as electronics, earthquake prediction and biotechnology.

Besides these, the designated research is executed. This project research is aimed at R&D in industrial science and technologies called the "Industrial Science and Technology Frontier Program," R&D on energy and environment technologies called the "New Sunshine Program" AIST institutes are taking charges of fundamental fields represented by the above-mentioned project.

Reorganization

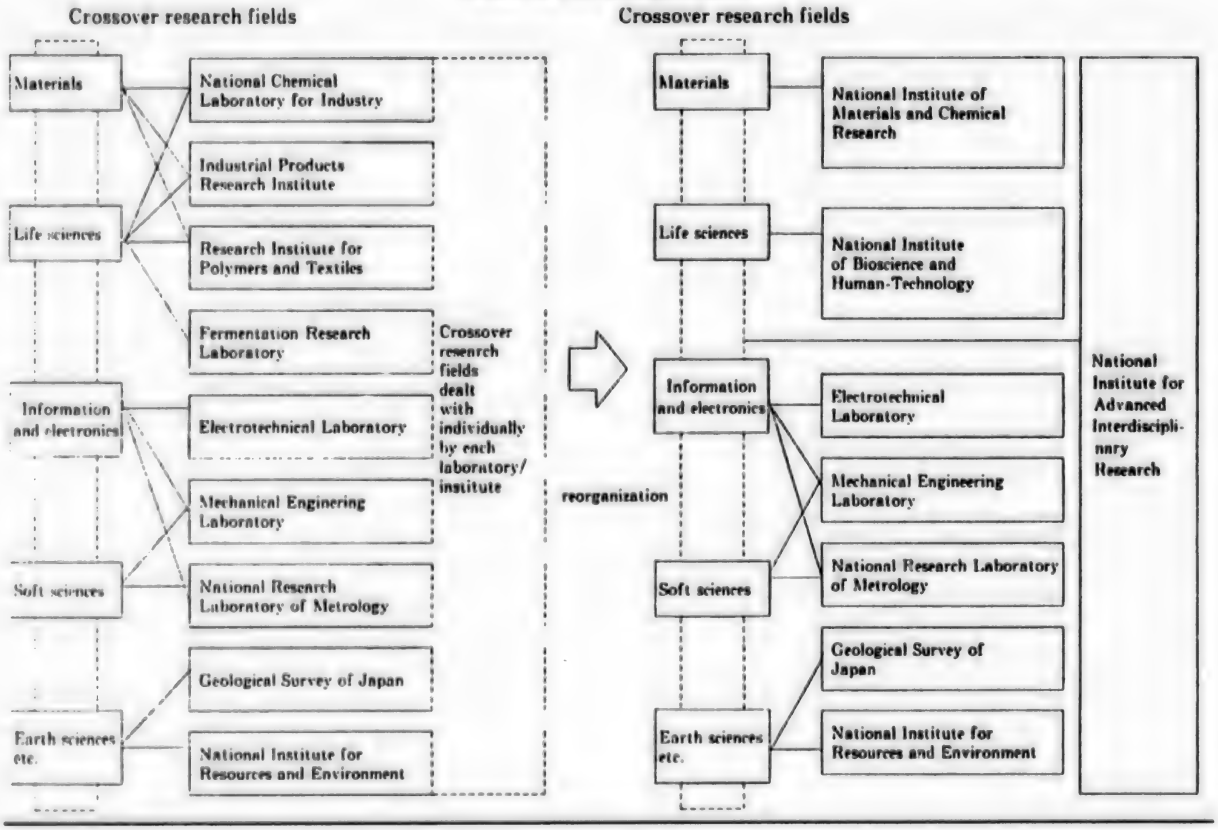
On January 1st, 1993, two new institutes were established, the National Institute of Material and Chemical Research and the National Institute of Bioscience and Human Technology, which will serve as cantors of technological innovation as the 21st century draws near. The goal of these two institutes is to fundamentally reinforce scientific efforts in the fields of materials engineering and applied biology, both of which involve key technologies that are crucial to industry as a whole.

A National Institute for Advanced Interdisciplinary Research Institute was also established on January 1st, which is organized in such a way as to enable interaction of all types, whether between industry, government and academia, across different scientific fields, or among nations. This will greatly strengthen Japan's capacity in crossover research combining knowledge from many different areas of science.

The Tsukuba Research Center

In fiscal year 1979, nine research laboratories under AIST, having previously been scattered over the Tokyo metropolitan area, moved to Tsukuba Academic City to form the Research Center of the Agency of Industrial Science and Technology. Consolidation of these eight institutions, reorganized from nine to eight in 1993,—

Chart of the Reorganization



National Institute for Advance Interdisciplinary Research, National Research Laboratory of Metrology, Mechanical Engineering Laboratory, National Institute of Materials and Chemical Research, National Institute of Bioscience and Human Technology, Geological Survey of Japan, Electrotechnical Laboratory and National Institute for Resources and Environment, helped the Center forge closer relations among AIST institutions and supported the efficient development of advanced research activities.

1. Project for Expanding Infrastructure for Research and Information Processing

To support, develop and permit more effective use of research and technological information and more advanced computerization and information processing, AIST is developing a system for promoting laboratory automation, constructing and expanding data bases on research and technology, and expanding networks. These activities are executed by the Research Information Processing System (RIPS), installed for joint use of AIST institutions in 1981.

2. Project for Promoting Research Cooperation

AIST is taking a variety of steps to promote close interaction among many institutions in Tsukuba, while stepping up private/public international technical exchanges and more effective use of research and technical information. This includes holding comprehensive symposiums and other forums at Tsukuba, accepting researchers from local countries and receiving technical trainees from local public entities and other organizations. These arrangements are aimed at strengthening research projects and encouraging studies in Japan.

3. Activities of RIPS (Research Information Processing System)

At the end of fiscal 1991, RIPS was upgraded to support advanced and efficient research activities in the AIST laboratories. Current RIPS, which consists of large-scale, general-purpose computer system (FACOM M-1800/30) and supercomputer system. (Cray XMP/216 and IBM 3090/18E), is operated to meet increasing demands for high-speed calculations and a variety of simulations. Moreover, a medium-speed channel (Ethernet) enhanced the information exchange among AIST laboratories.

National Institute for Advanced Interdisciplinary Research, 1-4, Higashi 1-chome, Tsukuba-shi, Ibaraki, 305; Tel: 0298 (54) 2500; Total personnel: 36; Total budget: ¥ 300 million

Description

Established just this year, National Institute for Advanced Interdisciplinary Research is devoted to research on subjects combining elements from various fields that cannot be adequately treated within the bounds of traditional divisions of science. Here specialists in different fields from government, universities and industry coming from both Japan and overseas collaborate on intensive research.

Outline of Research Activities

1. R&D on ultimate manipulation of atoms and molecules

(a) Observation and manipulation of atoms and molecules in solid surfaces

(b) Observation and manipulation of atom and assemblies in space

(c) Observation and manipulation of organic molecular structures etc.

(d) Theoretical analysis of atomic and molecular processes

2. Research on cluster science

(a) Experimental analysis of characteristics of dynamic clusters

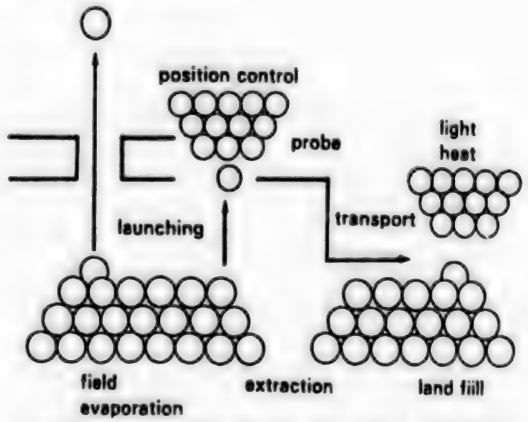
(b) Theoretical analysis of characteristics of dynamic clusters

(c) Physical properties of clusters and their utilization

3. Research on bionic design

(a) Biocrystallization

(b) Molecular machines



Ultimate Manipulation of Atom and Molecules

National Research Laboratory of Metrology, 1-4, Umezono 1-chome, Tsukuba-shi, Ibaraki, 305; Tel: 0298 (54) 4118, Senior Officer for Research Planning; Total personnel: 207; Total budget: ¥ 2.4 billion

Description

The National Research Laboratory of Metrology (NRLM) is the national representative institute for standards of length, time, mass, temperature and related quantities in Japan, and takes the lead in unifying units of various physical and engineering quantities and improving standards for science and technology. The research works cover broad fields for the development and the improvement of standards. The NRLM is responsible for establishing working standards and calibration of measuring instruments in compliance with the Measurement Law. Technical consultancies are also being carried out. Another important responsibility is to promote international cooperation for metrological unification, in pursuance of the Metric Convention. The NRLM keeps close contact with the International Bureau of Weights and Measures, the International Bureau of Legal Metrology and the research institutes for standards in many countries.

The major research projects of the institute are as follows:

Outline of Research Activities

1. Standards and Metrology: (1) Basic standards of length, time, temperature and mass; (2) Industrial standards of density, force, pressure, flow rate, vibration, shock acceleration, surface roughness, particle size and viscosity.

2. Applied Precision Metrology: (1) Precision measurement of laser frequency; (2) Precision nonlinear spectroscopy; (3) Precision long distance measurement; (4) Nanometrology; (5) High temperature thermophysical properties; (6) Thermal and mechanical properties of solids; (7) Thermophysical properties of fluids; (8) Precision dimensional metrology; (9) Measurement system and evaluation; (10) Reliability of measurement apparatus; (11) Measurement for high temperature superconductivity.

Mechanical Engineering Laboratory, 1-2, Namiki, Tsukuba-shi, Ibaraki, 305; Tel: 0298-58-7016, Fax 0298-58-7033 (Research Planning Office); Total personnel: 254; Total budget: ¥3,600 million

Description

The Mechanical Engineering Laboratory (MEL) was established in 1937 with the objective of promoting advancement of Japan's machine industry. Today, still maintaining its conventional role, MEL is changing and expanding its role for the development of new engineering technologies through association of mechanical engineering with other basic science, development of basic technologies in mechanical engineering towards their limits, and development or intelligent machines systems. The major R&D fields are shown below:

Outline of Research Activities

1. Basic Engineering: (1) Optics, Instrumentation and control; (2) Precision components for micromachines; (3) Tribology; (4) Control of noise and vibration.

2. Materials and Manufacturing Engineering: (1) Synthesis and evaluation of novel materials; (2) Advanced metal forming and high-precision machining/grinding; (3) Advanced surface processing and joining; (4) Intelligent manufacturing system.

3. Energy Technology: (1) Wind power conversion system; (2) Advanced combustion engines and emission control; (3) High-performance heat transfer/exchange; (4) Ceramic gas turbines.

4. Robotics and Intelligent Machines: (1) Locomotion and manipulation; (2) Motion control; (3) Man-robot interface.

5. Bio-engineering: (1) High performance biocompatible materials; (2) Medical and human welfare apparatus.

National Institute of Materials and Chemical Research; 1, Higashi 1-chome, Tsukuba-shi, Ibaraki, 305; Tel: 0298 (54) 6227 (Research Planning Office), 0298 (54) 4423 (Technology Exchange Center); Total personnel: 419; Total budget: ¥6.0 billion

Description

The National Institute of Materials Chemical Research was established on January 1st, 1993, to lead research on materials and chemistry. A major role of materials science is to build up a systematic understanding at the level of molecular theory of the formation and properties of materials and their dynamic behavior; this knowledge can then be utilized to develop innovative methods for producing materials and endow them with novel functions. The NIMC is aiming at generating scientific technologies in the field of materials and chemical research which enhance quality of human life and contribute to the progress of industry. To this end, comprehensive research projects are underway in five main areas as listed below.

Outline of Research Activities

1. Exploration of new synthetic methods and development of materials processing.

Research on advanced organic synthesis, new catalyst technologies, high energy chemistry, molecular engineering, nano-technologies, advanced materials processing, etc.

2. Development of analytical science and construction of theories leading to exploration of new concepts and functions of materials/substances.

Research on surface phenomena, non-linear phenomena, non-equilibrium systems, new analytical methods, etc.

3. Creation of new materials/substances learned from nature.

Research on biomaterials, autonomous reaction materials, information substances and materials, etc.

4. Development of technologies relating to energy and environment technologies.

Research on hydrogen utilization technology, energy-related materials, environmentally friendly chemical systems, etc.

5. Development of standards and safety technologies

Research on chemical standards, prediction of explosion, hazards, material durability, specialty gases etc.

National Institute of Bioscience and Human-Technology, 1-3, Higashi 1-chome, Tsukuba-shi, Ibaraki, 305; Tel: 0298 (54) 6023 (Research Planning Office); 0298 (54) 6024 (Technology Exchange Center); Total personnel: 221; Total budget: ¥1.4 billion

Description

Established on 1 January, 1993, the Bio-Engineering Industrial Technology Research Institute brings together the fields of biotechnology, biomedical engineering and human engineering, all of which relate to the living organism yet have heretofore remained largely self-contained, under the aegis of a new concept, bio-engineering. The Institute is highly innovative even by international standards in that it treats everything from biotechnology to human technology as an organic whole, and it is dedicated to performing basic, original research in order to throw light upon the phenomenon of life and establish new industrial technologies on the basis of the knowledge thus obtained.

Outline of Research Activities

1. Analysis of biological organisms and functions

(a) Analysis of the structure, functions and synthesis of biological and biologically-related substances

(b) Analysis of the structure and functions of biological molecular aggregates and their control and artificial duplication

(c) Analysis of the structure and functions of genes and gene-expression products relating to biological functions

2. Analysis and application of the functions of microbes, etc.

(a) Analysis and application of microbes and their biological functions

(b) Analysis of biological reactions and functional analysis and application of reactive products

3. Information transmission functions

(a) Analysis and application of structures and functions in cells and tissue of organisms

4. Human engineering (medicine and welfare, residential systems, lifestyle assets, etc.)

(a) Understanding and application of the superbly-developed functions of the human organism

(b) Interaction and interface between man and his environment

5. Deposit of patents on microbes

The only depositing body in Japan designated by the Director of the Patent Agency, the Institute is an international depositing body under the Budapest Treaty.

Geological Survey of Japan, 1-3, Higashi 1-chome, Tsukuba-shi, Ibaraki, 305; Tel: 0298 (54) 3572 (Research Planning Office); Total personnel: 333; Total budget: ¥4,565

Description

Established in 1882, the Geological Survey of Japan is the only national research institute in the country concerned with the systematic investigation of geology and mineral resources. It is responsible for geological sheet mapping and for research on geology and various kinds of resources (metallic and non-metallic minerals, fuel, geothermal energy and ground water) in the Japanese archipelago and adjoining offshore areas. Its work has contributed substantially to environmental conservation and to mitigating damage from geological hazards such as earthquakes, volcanic eruptions and landslides. The Survey also takes an active part in efforts in international research projects and technical cooperation. Experts on geology, mineral resources and environment are sent overseas and foreign researchers are admitted to the relevant department in the Survey. In addition, the Survey provides technical guidance to other agencies, local governments and the general public. The results of its work are published in the form of various scales of geological and thematic maps, bulletins and special publications. Major research programs in each field are as follows.

Outline of Research Activities

1. Geothermal resources: (1) Confirmation study of the effectiveness of prospecting techniques for deep geothermal resources; (2) Basic study on nationwide and regional geothermal assessment.

2. Disaster prediction and environmental research: (1) The geological study of earthquakes; (2) Geological, geochemical and geophysical study of active volcanoes; (3) Long range prediction model for changes in the shallow water environment to enable optimum industrial development use.

3. Marine geological studies and environmental observation.

4. Geological study for atomic energy utilization: (1) Geological study of deep underground disposal of high-level radioactive waste; (2) Study on evaluation methods for discontinuity in basement rocks beneath atomic energy facilities.

5. International cooperation: (1) Mechanism of methane discharge into atmosphere; (2) Geology and mineral resources in Mongolia; (3) Geology and coal bearing basins in Malaysia and Indonesia; (4) Hydro-environmental characteristics of arid-semiarid regions in China; (5) Mineral resources assessment of fragments of oceanic plates in Indonesia.

Electrotechnical Laboratory, 1-4, Umezono 1-chome, Tsukuba-shi, Ibaraki, 305; Tel: 0298 (54) 5006 (Research Planning Office); Total personnel: 640; Total budget: ¥ 10,058 million

The Electrotechnical Laboratory (ETL) was founded in 1891 as a testing laboratory for electrical insulators under the Ministry of Communications. After several major organizational changes since then, including the separation of what is now the Electrical Communication Laboratories, NTT, in 1948, the ETL now stands as the largest national research institute in Japan. For promoting future industrial science and technology, the ETL is responsible for conducting advanced research and development in electronics, standards and measurements, energy, and information and computer science. A list of ETL's notable achievements begins with the wireless telegraph, developed as early as 1896, and includes, just to name a few, Japan's first transistorized computer—the Mark IV (1959); the Kondo effect (1964), which later earned the London Award for Dr. Kondo, ETL Advisory Fellow; the genuinely data-driven computer EM-4 (1990); the discovery of a new type of oxide superconductor and the development of Josephson Computer ETL-JC1 (1989); and the record high-power excimer laser ASHURA (1989).

The ETL consists of 14 research divisions located in Tsukuba Science City and one research center in the Osaka area. Within 58 sections some 530 researchers, including approximately 260 Ph.D.'s are now actively working in the vast new frontiers of science and technology.

Outline of Research

The major research topics are:

(1) Electronics fundamentals: physical studies on superconductivity, dynamics of elementary excitations, etc., development of new superconductors, opto-electronic materials, and amorphous semiconductors, VLSI technologies based on superlattice and three dimensional structures, advanced microfabrication technologies, supermolecular technology utilizing organic molecular assemblies, and biochemical and physiological studies on information processing in living organisms;

(2) Standards and measurements; establishment and supply of national standards of electricity, photometry, acoustics, and ionizing radiation and radioactivity, and advanced measurement techniques based on the uses of quantum effects and of sound and electromagnetic waves;

(3) Energy-related technologies: utilization of solar and other environmental energy sources, fuel cells and redox flow batteries, magnetically and inertially confined nuclear fusion, advanced laser technologies, and superconductor application technologies;

(4) Information and computer technologies: cognitive science and its applications, artificial intelligence, pattern recognition, parallel processing computer architecture, software engineering, and intelligent robotics.

The ETL, keenly aware of the increasing importance of technical exchanges both with the private sector and academia, is also actively participating in a wide range of cooperative research efforts.

National Institute for Resources and Environment, 16-3, Onogawa, Tsukuba-shi, Ibaraki, 305; Tel: 0298 (58) 8111 (Research Planning office); 0298 (58) 8105 (Technology Consultation Office); Total personnel: 295; Total budget: ¥ 4.1 billion

Description

The National Institute for Resources and Environment was established in 1991 as a centre of research on topics relating primarily to the global environment, including conservation of regional environments, development and exploitation of resources and energy, and industrial safety. The Institute is a reorganized version of the National Research Institute for Pollution and Resources, itself the successor of the Resources Research Institute, which was organized by combining the Fuel Research Institute established in 1920 and the Mining and Safety Research Institute established in 1949.

Outline of Research Activities

1. Global Environment

(a) A balance assessment of substances causing global warming in the environment

(b) Development of a circulation model of substances causing global warming

(c) Recovery and fixation of carbon dioxide using adsorbent materials

(d) Technologies for decomposing chlorofluorocarbons and methane

(e) Research on carbon dioxide fixation using biomasses.

2. Regional Environment

(a) Measurement and analysis of pollutants in atmospheric and hydro-spheric environments

(b) Environmental assessment and modeling

(c) Reduction of pollutant emissions

(d) Control of hazardous or refractory organic substances

3. Resources

(a) Development and refining of natural resources

(b) Preparation of advanced materials

(c) Development of underground space

(d) Recycling of industrial wastes

4. Development of Energy

(a) Technologies for conversion of coal to liquid and gas

(b) Development of hot dry rock geothermal energy

(c) Improvements in combustion techniques and development of energy-saving technologies

(d) Evaluation of wind-power generating sites

5. Safety Engineering

(a) Prevention of fires, explosions, corrosion and destruction

(b) Mining safety

(c) Safety assessment of underground construction

Government Industrial Development Laboratory, Hokkaido, 2-17-12-1, Tsukisamu-higashi, Toyohir-ku, Sapporo 062; Tel: 011 (857) 8402 (Research Planning Office), 011 (857) 847 (Technology Information Center); Total personnel: 96; Total budget: ¥ 1.4 billion

Description

The Hokkaido Industrial Development Laboratory, Hokkaido has in its capacity as a national laboratory, done extensive researches on advanced technologies, boasting a considerable record of achievement in promoting the evolution of industrial technologies in Hokkaido. The Laboratory concentrates on three areas, resources and energy, applied chemistry, and development of materials, conducting its research in a multidisciplinary fashion from the standpoint of cold-climate technology, low-temperature engineering, and techniques for utilizing microgravity environments.

Outline of Research

Activities

1. Resource and energy technologies

(a) Analysis of the properties of coal, etc., and establishment of technologies for converting it to liquid and gas

(b) Development of new forms of energy using untapped resources

(c) Establishment of energy-conversion technologies for cold climates

2. Global environment and prevention of environmental pollution

(a) Establishment of methods of high-efficiency coal combustion to minimize bad effects on the environment

(b) Establishment of technologies for recycling resources and clean disposal of wastes

3. Materials

(a) Development of methods for designing and producing new functional materials

(b) Structure control technology to endow materials with advanced functions

(c) Functionalization and control of heterogeneous interfaces

4. Biotechnology

(a) Development of precise organic synthesis and new catalysis technology using enzymes

(b) Functional analysis of specific enzymes and development of their use

5. Cold-climate technology/low-temperature engineering

(a) Utilization of biomass resources in cold regions

(b) Probing for low-temperature microbes and technologies for protecting the environment

(c) Development of low-temperature materials and their application technologies

(d) Research of mechatronics on snow-related technologies

6. Technologies for utilizing microgravity, environments

(a) Techniques of manufacturing new functional materials in microgravity environment

Government Industrial Research Institute, Tohoku, 4-2-1, Nigatake, Miyagino-ku, Sendai-shi, Miyagi-ken; Tel: 022 (237) 5211; Total personnel: 53; Total budget: ¥ 700 million

Description

Since its establishment in 1967 the Government Industrial Research Institute, Tohoku has engaged in a wide variety of research designed to contribute to industrial growth in the Tohoku region of Japan. The Institute is endeavoring to establish itself as a major research center in the field of metal materials engineering, and to that end it is currently carrying out advanced and basic research. It also takes part in national projects run by the government, most notably in the area of development of

materials, and is involved in technology development projects and international research programs intended to revitalize local industries.

Outline of Research Activities

1. Technology for Development of New Materials

(a) Research on production of new metallic powders

(b) Preparation of metal-selective substances having high molecular recognition properties and their applications to the separation of rare metals

(c) Research on producing technique of synthetic buffer material for geological disposal of high level nuclear waste

(d) Fundamental studies on application techniques of host-guest reaction for creation of novel functional materials

(e) Research on synthesis and utilization of interstratified compounds

(f) Study on development of particle-dispersion-strengthened materials

2. Evaluation and Measurement of Materials

(a) Advanced technology for internal inspection of composite materials

(b) Evaluation of the mechanical properties of ADI

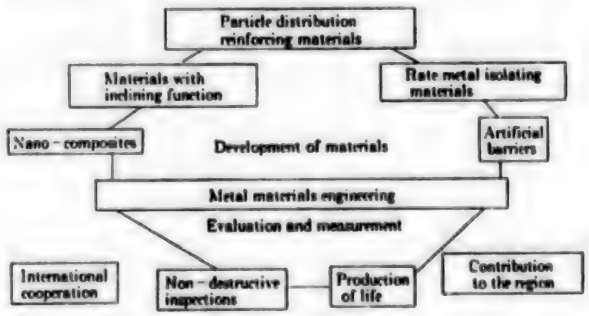
(c) Study on development of geothermal materials

3. Research Program for the Development of Regional Technology

(a) Geothermal data analysis of well-stimulation experiment by hydraulic fracturing

(b) Study on extraction of lipids related functional substances from marine organisms

(c) Study on techniques for refining and chemical modification of biomass components



Research Fields

Government Industrial Research Institute, Nagoya, 1-1, Hirate-cho, Kita-ku, Nagoya-shi, Aichi, 462; Tel: 052 (911) 2111; Total personnel: 230; Total budget: ¥2,750 million

The Government Industrial Research Institute, Nagoya (GIRIN) was established in 1952 as a national research center to contribute to R&D on advanced regional technology as well as national program. Research activities are conducted in six departments, namely, Mechanical Engineering, Chemistry, Radiation Research, Ceramics Science, and Ceramics Technology. It has 230 staffs and ¥2.8 billion budget in total in fiscal year 1993. One division in Ceramics Technology is located at Seto-city, which is well known for her largest production of pottery and porcelain wares in Japan, to contribute to her regional technology.

Since its establishment, GIRIN has played an important role for R&D on such industrial science and technology as liquid bulge forming, casting and foundry technologies, synthesis of organic fluorine compounds, radiation graft polymerization, solar energy utilization, functional and engineering ceramics, and pottery and porcelain production technologies.

GIRIN has recently focused her research activities more on inorganic material (ceramics) research aiming to Energy (including hard energy technologies for high temperature gas turbine, nuclear fusion, and large power transportation, soft energy technologies such as passive solar device, and energy conservation technologies) and Space & Aircraft technologies. GIRIN is executing 41 research projects in conjunction with national R&D projects such as Industrial Science and Technology Research and Development Program (High temperature ceramic super conductor, Intermetallic compounds, Surface modification of ceramics by beam technology, Integrated advanced materials), New Sunshine Program (Passive solar device, Plant growth regulators for biomass plants, Ceramic gas turbine) and Special Research Projects (Bio-ceramics and other functional ceramics, Functional organic fluorine compounds) and so forth. It is also conducting 40 basic research programs. Among those, new metals and casting technologies, environmental protection technologies, radiation physics and chemistry, biotechnologies and, pottery and porcelain technologies are included.

GIRIN has been actively joining in the bilateral international cooperative research programs under AIST scheme in the field of fluorine bionics organic compound, acid rain project, and utilization of indigenous materials in developing countries as well as in multinational cooperative programs under IEA in the fields of ceramics and solar materials.

Government industrial Research Institute, Osaka, 8-31, Midorigaoka 1-chome, Ikeda-shi, Osaka, 563; Tel: 0727 (51) 9681 (Research Planning Office); Total personnel: 207; Total budget: ¥2,917 million

The Government Industrial Research Institute, Osaka was established in 1918. Since then it has produced a number of outstanding research achievements in the exploration and development of new materials including carbon fibers and electrically conductive transparent thin films. Our research institute consists of five research departments and is giving priority to the following research fields:

1) Energy-Related Materials: materials for energy conversion such as for batteries, fuel cells, electrolysis processes, and hydrogen energy, high-temperature ceramics for gas turbines, etc.

2) Optical Materials: glasses and thin films for optics, non-linear optical materials, optical chemical sensors, etc.

3) Functional Surface Materials: heterogeneous catalysts, biocompatible materials, atomic-scale designing of graphite intercalation compounds, new functions and theoretical analyses of the interconnection in composite materials, surface modification with ion implantation, etc.

In addition to the above fields of materials research, the following lines of approach are also being put forward:

1) Intensification of innovative, fundamental studies to create highly advanced functions of materials.

2) Initiation of unexplored approaches to materials through human sensation and feelings.

3) Fermentation of basic science concerning the creation and analyses of novel materials through atomic-scale techniques and computer calculation and graphics.

4) Promotion of R&D programs for global environmental technology.

Through the above research activities, our institute encourages contacts and cooperation between industrial and university research on a regional, national, and international level.

Government Industrial Research Institute, Chugoku, 2-2, Hirosuehiro 2-chome, Kure-shi, Hiroshima, 737-01 Kure; Tel: 0823 (72) 1111; Total personnel: 51; Total budget: ¥7 billion

The Government Industrial Research Institute, Chugoku was established in 1971 to conduct pollution control studies in the Seto Inland Sea and engineering studies to develop new industrial technology in the Chugoku district. Since then, there have been many noteworthy achievements by the Institute. Results, including research on dissolution of pollutant out of the bottom sediment in the Seto Inland Sea, development of a fresh surface characterizing microscope using exo-electron, and materials evaluation in severe environments.

Research Subjects

1. Research on Environmental Protection

1) Ocean engineering techniques with the largest hydraulic model of the Seto Inland Sea in the world

2) Development of removal technology of polluted sediments

3) Physical, chemical and biological oceanographic

4) Water quality for nutrients and trace metals

2. Research on Biotechnology

1) Production and utilization of useful substances by photo-synthetic microorganisms

2) Characterization of membrane of deep sea microorganisms

3. Research on Material Evaluation

1) Hydrogen environment embrittlement of steels in high pressure hydrogen

2) Prediction of environmental degradation for materials

3) Ultrasonic characterization of microstructures

4) Fract-emission on various materials

5) Molecular beam epitaxy

4. Research on Computer science

1) Visual recognition and identification for flexible manufacturing system

The institute also conducts marine biology studies under a major national R&D program, a materials study of hydrogen energy under national R&D projects focusing on new energy, computer image processing studies for developing specific regional technology, and international joint research in the area of corrosion and environmental fields.

Government Industrial Research Institute, Shikoku, 3-3, Hananomiya-cho 2-chome, Takamatsu-shi, Kagawa, 761 Takamatsu; Tel: 0878 (67) 3511; Total personnel: 47; Total budget: ¥665 million

The Government Industrial Research Institute, Shikoku was established in 1967 as an R&D center for developing mining and industries in the Shikoku region, taking advantage of its mild climate and location near the sea and rich forest resources. Its R&D centers upon pulp and paper technology and in developing marine resources, it is primarily concerned with extraction and uses of minor elements dissolved in sea water, and underwater welding and cutting.

Balancing its regional and national interests, the institute has emphasized research in marine resources, functional resources and mechatronics. Furthermore, our institute is the leader in the Shikoku region for research and technologies.

The major research area of the institute are as follows:

1. Extraction and Utilization of Marine Resources

(1) Manufacturing process of high-functional chemicals from sea microorganism

(2) Adsorbents for isolating and extracting light-element isotopes

(3) High performance composite material forming whisker

(4) Techniques for forming hyperfine particles from natural macromolecules

(5) Development of alternative materials to hawksbill turtle shell

(6) Production of fiber from marine polysaccharides and their application to functional material carriers

(7) Technologies for recovering valuable elements in brine

2. Basic technologies

(1) High-energy-beam hybrid processing for functional oceanic materials

(2) Long-arm control technology utilizing miniature active mass dampers

(3) Dynamic control of nonlinear pendulums

(4) Processing technologies using a laser assisted hybrid beam

(5) Analysis and evaluation of solar electric power generating systems

Government Industrial Research Institute, Kyushu, Shuku-machi, Tosu-shi, Saga, 841 Tosu, Tel: 0942 (82) 5161; Total personnel: 90; Total budget: ¥1,024 million

The Government Industrial Research Institute, Kyushu was established in 1964 to contribute to developing mining and industries in Kyushu.

The institute has conducted 19 special research and 35 general research projects in the following major fields:

1. Composite material production technologies

(1) Technologies for producing carbon-based composite materials for use in high-efficiency power generation

(2) Inorganic fusion materials with higher order structure

(3) Technologies for controlling the structure of components with multiple functions

(4) Techniques for manufacturing functional superplastics using the powder method

(5) Development of super-heat-resistant $MoSi_2$-based compound ceramics

(6) Development of fiber-reinforced ceramics for high temperature use

2. Material production technologies

(1) Production of metalloid isolating agents using sugars and analogous substances

(2) Development of flame-retardant Mg alloys and semi-fusion molding techniques

(3) New technologies for isolating cesium using redox-type ion exchangers

3. Natural resource processing technologies

(1) Coal liquefaction techniques

(2) Biomass processing technologies, especially for tropical and semitropical plants

(3) Synthesizing inorganic-stratiform polymers and endowing them with functionality

4. Material processing technologies

(1) A hybrid machining system for ceramics

(2) Techniques for bonding ceramics and metals

The New Energy and Industrial Technology Development Organization

The New Energy and Industrial Technology Development Organization (NEDO) has been given the central role in research and development on industrial technologies under the Industrial Technology Research and Development Consolidation Act. Here is a brief description of NEDO's various activities.

1. Research and Development (Budget: ¥30.4 billion)

NEDO is involved in such R&D projects in the field of industrial technology as the Industrial Science and Technology Frontier Program described earlier and the R&D Program on Industrial Technologies Relating to the Global Environment. In all of these it takes an integrated, dynamic approach to research and development, working to ensure greater coordination between the efforts of government, industry and academia in Japan as well as researchers in other countries, and encouraging the practical application of the benefits of such programs.

2. Research Infrastructure

In order to provide researchers in both Japan and other countries with broad access to the extensive, sophisticated research facilities they need to make progress in creative R&D on advanced scientific fields, NEDO, along with local and regional governments and private industry, supplies funding to the following five centers:

(1) Ion Engineering Center: A facility for research on technologies for utilizing ion beams in industry.

(2) Japan Microgravity Center: A vertical-drop facility where various microgravity experiments of about 10 seconds' duration can be performed using an old mine shaft.

(3) Applied Laser Engineering Center: A facility for researching technologies on applying lasers in industry.

(4) Advanced Material Research Center: A facility for researching and evaluating the physical properties and functions of materials in super-high-temperature environments.

(5) Industrial Marine Technologies Research Center: A facility for research on technologies for utilizing marine organisms in industry.

3. International Industrial Technology Programs

Science knows no borders, and there is a greater need now than ever for various forms of international collaboration on research. It is with this in mind that NEDO undertakes the following four interrelated programs:

(1) International joint research (budget: ¥ 5.7 billion)

Joint research with overseas institutes is conducted on subjects in which the other country has expressed an interest, mobilizing the talents and expertise of Japan's national laboratories and with the cooperation of the private sector. In addition essential technologies are transferred to developing nations through joint research projects with institutes there.

(2) International research fellowships (budget: ¥ 300 million)

(See "Promotion of International Research Cooperation.")

(3) Research education (budget: ¥ 300 million)

Research education programs in the form of classes and hands-on training at national laboratories are undertaken with the aim of nurturing researchers in Japanese and overseas companies and organizations and fostering contacts between them.

(4) Support for international joint research (budget: ¥ 900 million)

(See "Promotion of International Research Cooperation.")

Japan Key Technology Center

Japan Key Technology Center conducts activities directed at the overall improvement of the environment for private research and development in fundamental technologies.

(a) Capital Investment

The Center provides capital investment for R&D projects to be implemented from the basic or applied research phase, when two or more companies set up an R&D company. (Budget for FY1993: ¥ 21.5 billion)

(b) Loan Service

The Center provides conditional interest-free loans to aid reducing R&D related costs. (Budget for FY1993: ¥ 6.5 billion)

(c) Coordination of Joint Research

The Center coordinates private companies wishing to conduct joint research and national research institutes.

(d) Execution of Consigned Research

The Center brings together experts from government, industry, and academia to conduct research consigned to The Center by private companies.

(e) Japan Trust International Research Cooperation Service

The Center has established a charitable trust called the Japan Trust Fund. The operating profits from this fund will be used to invite outstanding foreign researchers in key technologies to Japan.

(f) Research Information Service

The Center collects and sorts a wide variety of important research literature which is kept on file at national research institutes and government-official organizations, and the Center provides this research information for the private-sector.

(g) Survey Service

The Center conducts various kinds of surveys to aid private-sector research in key technologies.

(Note)

"Key Technologies" means those technologies related to mining, manufacturing, telecommunications and broadcasting (including cable broadcasting)and radio communications technologies which fall under the jurisdiction of MITI or MPT, and which are expected to be conducive to enhancing the foundation of our economy and living standards.

Foreign Broadcast Information Service (FBIS) and Joint Publications Research Service (JPRS) publications contain political, military, economic, environmental, and sociological news, commentary, and other information, as well as scientific and technical data and reports. All information has been obtained from foreign radio and television broadcasts, news agency transmissions, newspapers, books, and periodicals. Items generally are processed from the first or best available sources. It should not be inferred that they have been disseminated only in the medium, in the language, or to the area indicated. Items from foreign language sources are translated; those from English-language sources are transcribed. Except for excluding certain diacritics, FBIS renders personal names and place-names in accordance with the romanization systems approved for U.S. Government publications by the U.S. Board of Geographic Names.

Headlines, editorial reports, and material enclosed in brackets [ ] are supplied by FBIS/JPRS. Processing indicators such as [Text] or [Excerpts] in the first line of each item indicate how the information was processed from the original. Unfamiliar names rendered phonetically are enclosed in parentheses. Words or names preceded by a question mark and enclosed in parentheses were not clear from the original source but have been supplied as appropriate to the context. Other unattributed parenthetical notes within the body of an item originate with the source. Times within items are as given by the source. Passages in boldface or italics are as published.

SUBSCRIPTION/PROCUREMENT INFORMATION

The FBIS DAILY REPORT contains current news and information and is published Monday through Friday in eight volumes: China, East Europe, Central Eurasia, East Asia, Near East & South Asia, Sub-Saharan Africa, Latin America, and West Europe. Supplements to the DAILY REPORTs may also be available periodically and will be distributed to regular DAILY REPORT subscribers. JPRS publications, which include approximately 50 regional, worldwide, and topical reports, generally contain less time-sensitive information and are published periodically.

Current DAILY REPORTs and JPRS publications are listed in *Government Reports Announcements* issued semimonthly by the National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, Virginia 22161 and the *Monthly Catalog of U.S. Government Publications* issued by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402.

The public may subscribe to either hardcover or microfiche versions of the DAILY REPORTs and JPRS publications through NTIS at the above address or by calling (703) 487-4630. Subscription rates will be provided by NTIS upon request. Subscriptions are available outside the United States from NTIS or appointed foreign dealers. New subscribers should expect a 30-day delay in receipt of the first issue.

U.S. Government offices may obtain subscriptions to the DAILY REPORTs or JPRS publications (hardcover or microfiche) at no charge through their sponsoring organizations. For additional information or assistance, call FBIS, (202) 338-6735,or write to P.O. Box 2604, Washington, D.C. 20013. Department of Defense consumers are required to submit requests through appropriate command validation channels to DIA, RTS-2C, Washington, D.C. 20301. (Telephone: (202) 373-3771, Autovon: 243-3771.)

Back issues or single copies of the DAILY REPORTs and JPRS publications are not available. Both the DAILY REPORTs and the JPRS publications are on file for public reference at the Library of Congress and at many Federal Depository Libraries. Reference copies may also be seen at many public and university libraries throughout the United States.

END OF

FICHE

DATE FILMED

9 DEC 93